ELECTRONICS Australia

HIFI NEWS

DECEMBER, 1974
AUST 75c* NZ 75c

LSI DIGITAL ALARM CLOCK

TV SOUND —NEW SYSTEM

PROGRESS REPORT ON ARTIFICIAL HEARTS

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Sony's elegant PS-5100 turntable gives outstanding reproduction of the finest stereo records for both audiophiles and newcomers to hi-fi. Features aluminium diecast platter and high quality 4-pole hysteresis synchronous motor, automatic arm return, reject device, special damping device prevents pick-up damage, balanced tone-arm anti-skate device, and induced type magnetic cartridge. All in a timber cabinet with plastic dust cover which can be left open at any angle.

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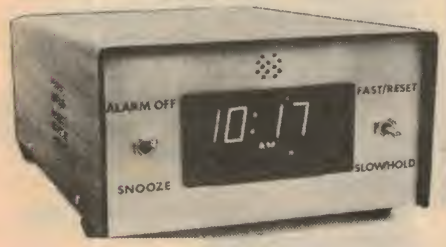

Our latest electronic clock offers a number of useful features. It provides an alarm, a circuit to switch off your radio after you fall asleep, a choice of hours and minutes display, or minutes and seconds, and a display which adjusts its brightness to suit the ambient light. A full description of how to make it appears on page 40.

For readers interested in logic circuits, and particularly those who build, check, or maintain them, the winning entry in the Electronics Australia/Kitsets competition will have a special appeal. It is a logic probe which can detect five distinct logic conditions and indicate them on a seven segment readout. Full constructional details on page 54.

On the cover

EA Editor Jim Rowe demonstrates his EDUC-8 microcomputer to Margaret Fahey, of the EDP Department at John Fairfax Ltd. In the background are visible two of the company's Digital Equipment PDP-8 machines, which are "bigger brothers" of the EDUC-8 machine. The description of our computer project continues on page 72.

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world of electronics and hi-fi

projects and technical

regular features

The three-in-one supply

The PE 1514 combines three constant voltage/current supplies in one compact housing. Two are continuously adjustable from 0 to 20 V and 0 to 800 mA and one from 0 to 7 V and 0 to 3 A.

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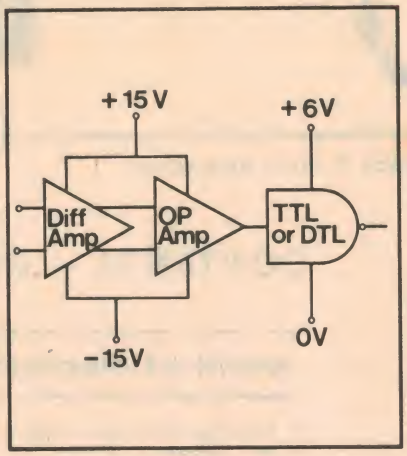

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Editorial Viewpoint

Christmas: time for positive thinking

As I sit down to write this leader, it certainly doesn't seem as if twelve months have passed since we produced our last December issue. A lot of things have happened on the Australian electronics scene in those twelve months, and they have simply flown.

Not all the things that have happened have seemed for the best, of course. In fact at times it has been hard to find a brighter side! Factories have been closing down, people have been losing their jobs, and there are rumours of more to come. There still seems a danger that Australia may lose most of the modest, but significant technological expertise it had in this field. And that is surely a sad prospect.

It is also both sad and ironic to record the closing down of the well-known Australian Radio and Television College, one of the oldest privately-run electronics schools in the country. This at a time when there has never been a greater need for trained electronics personnel in both the consumer and industrial areas.

There is a brighter side, of course. Colour TV transmissions are just about to start in earnest, and factories are busy cranking out receivers. Experimental FM stereo transmissions are not far away, and before long we seem likely to have video discs. Each week seems to bring news of new developments in solid state technology, digital electronics and a host of other fields. The stream of new devices seems to flow ever faster, and the potential applications fan out ever wider.

And despite the changes in financial climate some local parts and equipment manufacturers do have success stories to tell — like IRH Components with their metal glaze resistors, and Hy-Q Electronics with their quartz crystals. Hopefully when the dust clears and we all adjust to the altered situation, there will be more firms with similar stories — and we'll be happy to present them.

Yes, it's been a year marked by trauma and upheaval, and there may be more to come. But in the long term the electronics industry world-wide has a very bright future, and if we keep that prospect in view, it should be possible to weather the storms without permanent setback.

In the meantime, all of us here at E-A thank you all, readers and advertisers alike, for your continued support. We wish you the merriest possible Christmas, and a happy and prosperous new year.

— Jamieson Rowe

EDITOR-IN-CHIEF
Neville Williams
M.I.R.E.E. (Aust.) (VK2XV).

EDITOR
Jamieson Rowe
B.A. (Sydney), B.Sc. (Technology, NSW)
M.I.R.E.E. (Aust.) (VK2ZLO/T)

ASSISTANT EDITOR
Philip Watson
A.M.I.R.E.E. (Aust.) (VK2ZPW)

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GRAPHICS
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Editorial Office
12th Floor, 235 — 243 Jones Street, Broadway, Sydney, 2007 Phone 2 0944.
Postal Address: PO Box 163, Beaconsfield 2014.

Advertising Offices
Sydney — 57-59 Regent St, Sydney 2008. Phone 699 3622.
Representative: Mike Avey.
Melbourne — 425 St Kilda Road, Melbourne, 3004. Phone 267 3800.
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Representative: Jack Hansen. 21 8217.

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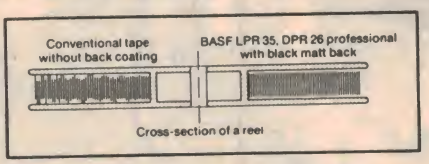

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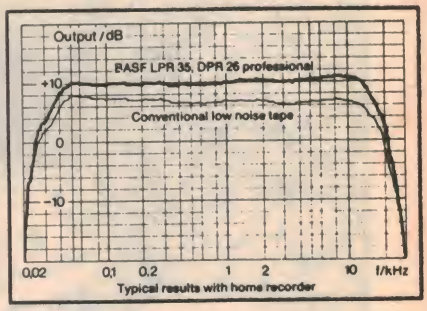

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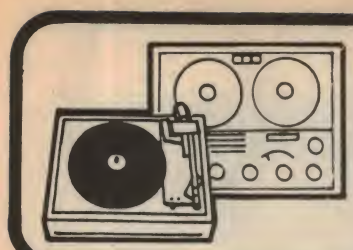

Hi Fi News

Hifi trends at Olympia Fair, London

The International Audio Festival and Fair at Olympia, London, is a mirror of the hifi market in Britain. This year, something like 100 exhibitors provided over 11,000 square metres of display in the Grand Hall, with equipment originating from almost all established hifi manufacturing countries including such relative newcomers as Poland and Hungary.

by HUGH JOHNSTONE *

There can be little doubt that the audio industry is one of the major growth areas in home entertainment and, certainly as far as the British market is concerned, looks like becoming of even greater importance. For the public the main showplace for audio products is the International Audio Festival and Fair, held this year at Olympia, London, from 28 October to 3 November.

Although all links in the sound reproduction chain are catered for by British manufacturers, the area of greatest strength is undoubtedly loudspeakers — which is also probably the most competitive section of the market!

With loudspeakers, personal preferences tend to play a far greater part in the final choice than with any other part of a system. And the great strength of British manufacturers is that the typical clean and open reproduction demanded by, and provided for, the knowledgeable home market is becoming more and more favoured by enthusiasts in other countries.

An interesting aspect of the established excellence of British speaker design is that certain overseas manufacturers have recently taken to having speakers developed and produced in Britain for inclusion in their own product ranges.

The recent upsurge in consumer interest in audio has led to a flurry of developments intended to help with the integration of a system into the domestic environment. A dedicated enthusiast may be willing to put up with a confusion of separate units and spaghetti-like connecting leads, but the new generation of users tends to seek greater simplicity.

Exemplifying this trend has been the emergence of "unit" systems in which a turntable, radio tuner, amplifier, and sometimes a cassette player / recorder, are integrated into a single module. All the problems of equipment matching and interconnection are taken care of by the manufacturer — the only operation necessary being the connection of a suitable pair of loud speakers, which themselves are normally either supplied or recommended by the manufacturer.

Until recently, systems of this type have generally been capable of only moderate performance levels, but there are definite signs that the concept is being extended to encompass combinations of equipment capable of giving true hi-fi standards.

Similarly there has been a pronounced movement towards the introduction of "receivers" which combine a tuner (invariably FM for good reproduction but sometimes also AM) and an amplifier. Main advantages of this arrangement are that the two units can be designed to work together for optimum performance. Further, the combined module, though often no smaller than two separate units, has a more generally acceptable appearance.

One of the most notable features of the audio market has been the rapid increase in the popularity of the compact cassette, an increase that has occurred at both ends of the equipment spectrum. For example, the portable cassette radio has become firmly established with teenagers.

At the other extreme, cassette recorders are making a definite impact on the hi-fi scene because of the high standards of reproduction made possible by the adoption of improved tape transport mechanisms, the Dolby B noise reduction system and tape formulations directed to the specific requirements of cassette recorders. Indeed the situation now is such that it seems certain that the cassette will oust reel-to-reel tape as the recording medium for all but the totally committed hi-fi enthusiast.

Quadraphonics has been hailed as the outstanding new development in hi-fi, and demonstrations of the various contending commercial systems were a feature of the

*Hugh Johnstone is the Editor of "Popular Hi-Fi", London.

Left: Departing completely from convention, this direct drive "turntable" is a product of Gale Electronics and Deisgn Ltd, 39 Upper Brook St, London W1Y 1PE. The main frame is a "Y" element of clear plastic, which supports the pickup base. The record sits on a 3-arm rotating platform, also of clear plastic. Extremely low wow and flutter is claimed. The speed can be varied within the limits 10 to 100rpm, with a digital readout of the setting.

Above: Very English in its styling, the Amstrad 8000 MkIII amplifier provides basic radio, tape and disc facilities without running to features which add unduly to cost and complexity. Power output per channel is 10W RMS, response 20Hz to 30kHz, and distortion at 1kHz 0.5pc. From AMS Trading (Amstrad) Ltd, 89 Ridley Rd, Dalston, London E8.

Olympia festival. Unfortunately, the situation still seems rather obscure. As yet there is no obvious leader in this field. Some sort of standardisation, such as occurred in the early days of stereo, seems to be necessary to permit real progress to be made.

So far as the British enthusiast is concerned, the situation has been further complicated by the emergence of an alternative surround-sound technique developed under the auspices of the National Research and Development Corporation. Known as Ambisonics, the technique aims to reproduce a sound field that is as faithful as possible to the original.

Prototype systems have been developed and the initial demonstrations proved convincing, but it has yet to be seen if the concept will be taken up commerically.

Mention has already been made of the high standing of British loudspeaker manufacturers. One name that has long been in the forefront is Tannoy, which has enjoyed considerable success with its Monitor range of dual concentric drive units. Essentially, these speakers consist of a direct radiating low frequency unit with a horn loaded high-frequency unit mounted coaxially with the bass driver and coupled to it electrically via a separate crossover network.

Recent developments have led to the introduction of an improved version of this design, the Monitor high performance dual concentric. Main features of the new range, compared with the previous Monitor Gold range, are high temperature voice coils, an improved and uprated crossover network and, on the larger versions, a Girdacoustic cone for the bass driver, as pictured.

The Girdacoustic loudspeaker cone, as now used in the larger models in the Tannoy Monitor high performance dual concentric systems.

Advantages accruing from these modifications are said to include increased power handling capcity (up to 85W for the 410mm model), higher sensitivity, smoother frequency response and a lower fundamental bass resonance, together with enchanced long-term performance stability.

However, consideration has also been given to the owners of earlier units and modification kits will be available to update the previous Monitor Gold units. (Tannoy Products Ltd, Norwood Road, West Norwood, London SE27 9AB.)

Although to a casual observer the trend with amplifiers seems to be towards ever higher power outputs, there is a continuing demand for more modest outputs. A company that has proved adept at meeting this demand is AMS Trading (Amstrad)Ltd whose latest offering is the 8000 MkIII stereo amplifier (see picture).

Rated at 10W per channel RMS with both channels fully driven into 8 ohm loads, this unit is said to have a frequency response of 20Hz to 30kHz and a total harmonic distortion of less than 0.5pc at 1 kHz.

Inputs are provided for both magnetic and ceramic cartridges as well as tape and tuner. Normal tone controls are incorporated, together with rumble and scratch filters and a loudness control. A modern appearance has been achieved by the use of slider controls and toggle switches and the amplifier is reasonably compact at 13in long by 8½in wide and 3in high (330mm by 216mm by 76mm).

Although nowhere so important as technical performance, the visual impact of a piece of hi-fi equipment can have a marked effect on its commercial viability, and a company that pays particular attention to this aspect — having first taken care to ensure the technical excellence — is Gale Electronics.

Olympia was chosen for the introduction by this company of a new direct drive turntable of unconventional design. Main constructional material is clear plastics with the base configuration conforming to what can best be described as a "Y". The extended arm of the Y serves to accommodate the pickup arm (SME as standard), and the direct drive motor and main bearing arrangement are mounted in the middle of the Y.

A magnetic bearing system using a rare-earth magnet is employed for the motor rotor with the three-armed record carrier sitting directly on the rotor assembly. Turntable inertia is provided by peripheral masses on the three arms and the record is supported by rubber rings on the tops of these masses and on a central hub.

It is claimed that this design offers the remarkable wow and flutter figures of 0.006/ unweighted RMS at 33-1/3 rev/min with an equally low figure for rumble. Turntable speeds are to be steplessly variable from 10 to 100 rev/min in steps of 0.1 rev/min, with the speed control built into a free-standing cylinder, coupled to the monitor by a supply cable. (Gale Electronics and Design Ltd, 39 Upper Brook Street, London W1Y 1PE.)

Despite the seemingly inexorable march of the compact cassette, reel-to-reel tape recorders remain unchallenged for serious recording and the needs of critical users can be met by machines from the Ferrograph Series 75 Super Seven range. This comprehensive range includes stereo half and quarter track models with and without integral amplifiers and speakers.

Normal speed ranges are 1⅞, 3¾ and 7½ in/sec (48mm, 95mm and 191mm/sec) but high speed versions with 15in/sec (381mm/sec) are also offered. Dolby noise reduction circuits can be incorporated if required. All models will accept 10½in (267mm) professional tape spools, provision being made to change the tape tensioning arrangements to suit the spool size in use.

Comprehensive controls for each channel include facilities for mixing line and microphone inputs together, and it is possible to achieve four-channel mixing on one track. Wow and flutter is given as less than 0.08pc at 7½in/sec (191mm/sec) for standard machines and the frequency response at the same speed is 30Hz to 17kHz + 2dB.

Returning to the final link in the audio chain, the speakers, it is encouraging to note that new designs aimed at the lower end of the market were also on show at Olympia. Brahms Manufacturing has updated its Medway range with the BT1000 model which has a single 8in (203mm) driver with parasitic cone. Power handling is 10W RMS and the frequency range is 70Hz to 14kHz.

Moving up the range, the BT1500 has an 8in (203mm) woofer (bass speaker) and a 3⅜in (86mm) tweeter (treble speaker) to give a 50Hz to 18kHz frequency range with a capacity of 15W. Top model in this series is the BT 2000 with 20W power handling and an increased frequency range (45Hz to 20kHz) using drive units of the same dimensions as the BT 1500.

Under the Brahms brand name there are four new speakers, ranging from the Sandringham to the Balmoral. The Sandringham has an 8in (203mm) woofer and a 4in (102mm) dome tweeter to give a 45Hz to 22kHz range at 20W, while the Balmoral will handle 50W over a frequency range of 35Hz to 22kHz and has a 12in (305mm) woofer, 5in (127mm) mid range and 4in (102mm) dome tweeter. (Brahms Manufacturing and Development Company, Unit E, Airport Works, Maidstone Road, Rochester, Kent ME1 3QJ, England).

This new turntable from Pioneer reflects the growing market demand for more sophisticated facilities on budget priced turntables. Designated the PL-12R, the new turntable is an updated version of the PL-12 series, and is supplied complete with magnetic cartridge.

Main features of the PL-12R include belt drive, anti-skating control, a direct readout stylus pressure scale, and an oil-damped cueing device. Tracking weight for the cartridge supplied is between 2.7 and 3.3 grams.

The platter, of aluminium diecasting, is some 30cm in diameter, and is driven by a 4-pole synchronous motor via a belt drive system. Two speeds only are provided — 33-1/3 and 45 rpm. Cartridge specifications include a frequency response of 20Hz to 23kHz, and an output voltage of 4mV at 1kHz and 50mm/sec. Wow and flutter is quoted as less than 0.1pc, while signal-to-noise ratio is quoted as greater than 47dB.

Recommended retail price of the PL-12R is $133.00. Warranty is 12 months from date of purchase.

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  8 ohms—greater than 200 w/chan.
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  ±1dB. 1 Hz to 100 KHz at 1 watt.
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  8 ohms—Less than .1% 20 Hz-20 KHz at full power.
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- **I.M.:**
  8 ohms—Less than .05% at full power.
  4 ohms—Less than .1% at full power.
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  Better than 100 db below 200 watts RMS.
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YAMAHA NS690/670

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- High space-factor voice coil windings for increased power handling
- Soft-dome transducers for smooth midranges and trebles
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- Low resistance crossover networks for minimum power loss and better speaker damping
- Extra-thick cabinet laminates for maximum structural stability.

SPECIFICATIONS

	NS-690	NS-670
Frequency response	35—20,000Hz	40—20,000Hz
Power handling capacity	60 watts	50 watts
Nominal Impedance	8Ω	8Ω
Type	3-way	3-way
Woofer	300mmϕ cone (JA-3056)	250mmϕ cone (JA-2501A)
Midrange	75mmϕ soft dome (JA-0701)	60mmϕ soft dome (JA-0601)
Tweeter	30mmϕ soft dome (JA-0509)	30mmϕ soft dome (JA-0509)
Crossover frequencies	800Hz, 6,000Hz	800Hz, 6,000Hz
Fundamental resonance frequency (f_o)	40Hz	45Hz
Operating power*	4 watts	6.3 watts
Dimensions	630mm H×350mm W×291mm D (24¾"H×13¾"W×11½"D)	577mm H×320mm W×269mm D (22¾"H×12⅝"W×10⅝"D)
Weight	22kg (48 lbs.)	19kg (42 lbs.)

*Input electrical power required to obtain 96dB sound pressure level at 1 meter according to DIN 45500. Specifications subject to change without notice.

CROSSOVER NETWORK

Yamaha have developed a totally new crossover network for the NS-600 series systems. It features special coils having extra thick 1mm diameter copper wire wound around ferrite cores. The copper wire minimizes power loss, and improves speaker damping because of its low electrical resistance. The use of ferrite cores offers similar advantages since it reduces the number of coil windings. Also utilized are metallized paper capacitors which, because of their low power loss factor, help to improve tonal quality. The NS-690/670 series crossover frequencies are 800Hz between woofer and midrange, 6,000Hz between mid-range and tweeter, and have a cut-off characteristic of 12dB/oct.

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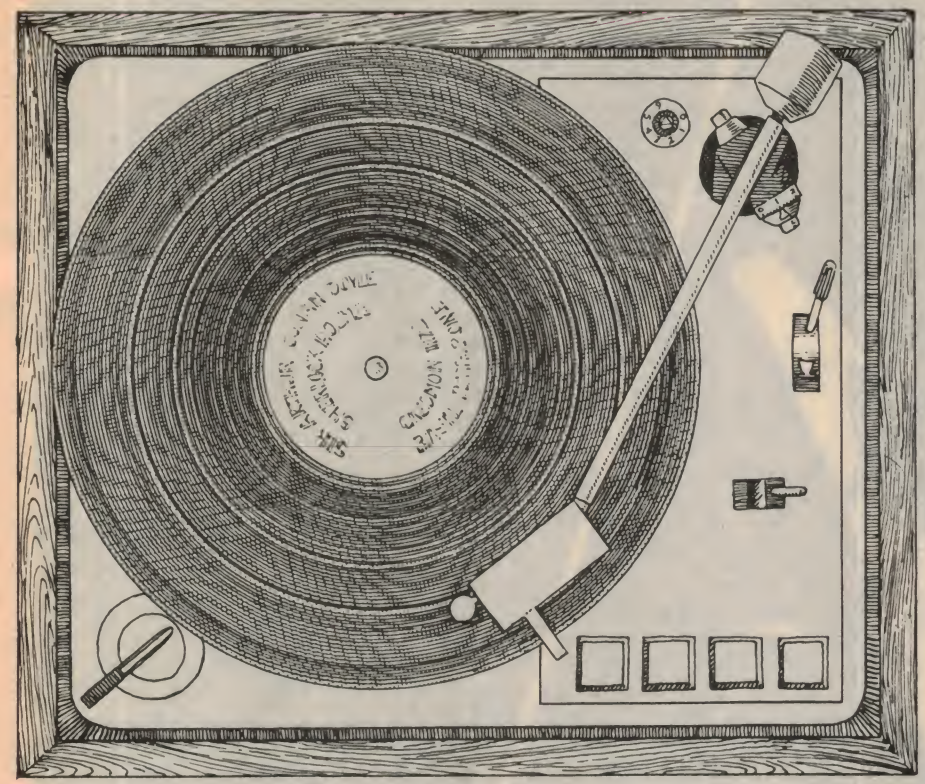
Things you need to know about . . .

RECORD PLAYERS



Julian Hirsch supplies the technical whys and wherefores, and Associate Technical Editor Ralph Hodges adds a gloss of buying guidance.

PART TWO

CABLE CAPACITANCE

The capacitance of the arm wiring and the cables connecting it to the amplifier is assuming greater importance with the advent of the CD-4 "discrete" four-channel record system. Most stereo cartridges are designed to give their flattest overall frequency response when loaded with from 250 to 350 picofarads (pF) capacitance (a typical range for most installations). However, there are certain cartridges that operate most effectively with 400 to 600pF. If in doubt, check with the manufacturer.

Most magnetic cartridges designed for CD-4 service, on the other hand, require an absolute minimum of capacitance in order to maintain their output up to frequencies as high as 45,000Hz. Special low-capacitance cables (about 50pF) are supplied with some CD-4 demodulators to replace the usual audio cables from the tone arm. This still leaves the internal arm wiring to be considered, and many arms, especially if they were designed before CD-4 was introduced, have more than 100pF in their internal wiring. More recent designs, or the current production models of some well-established arms, may already have low-capacitance wiring or can be modified. If you are planning to go to CD-4, it might be wise to check with the manufacturer of your equipment on this matter. Our test reports on record players include a check of the wiring capacitance.

Even if you have a high-capacitance arm, CD-4 operation is still possible. There are several types of non-magnetic CD-4 phono cartridges, and also at least one magnetic cartridge with low-inductance coils that does not require low-capacitance tone-arm and cable wiring.

Julian Hirsch, of the Hirsch-Houck Laboratory is a well-known writer on hifi topics. This article is reprinted from the July 1974 issue of "Stereo Review" magazine.

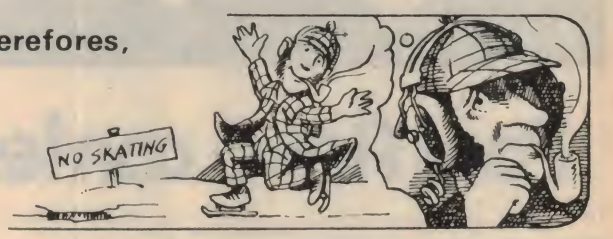
ANTI-SKATING AND CUEING

Anti-skating devices are intended to compensate for the effect of friction between the stylus and the record in an offset arm. This friction adds a force tending to move the tone arm toward the centre of the record, thus effectively increasing the stylus force against the inner groove wall and decreasing it against the outer wall. In other words, these skating forces add to and subtract from the vertical tracking force, in different directions.

A cartridge operating near the lower limit of its useful range of force may have insufficient tracking force for the outer wall; the results can be heard as a shattering mistracking distortion in the right channel when playing heavily recorded passages.

In the absence of an anti-skating system, the vertical tracking force can be increased slightly to compensate for the effect. However, when the cartridge is to be operated at the lowest possible force, a good anti-skating system is a necessity. Its purpose is to supply an outward torque to the arm, equal and opposite to the skating force.

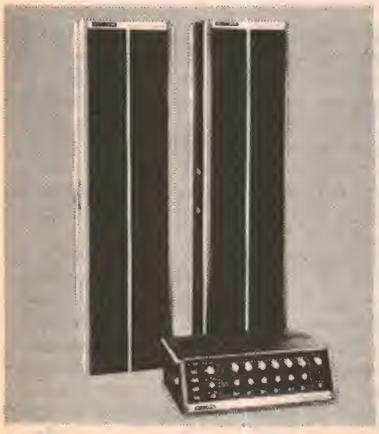
Most arms have their anti-skating adjustment calibrated to match their tracking-force dials, since the two are related. Do not attach undue importance to these markings, although in most cases they are sufficiently accurate for their purpose and certainly better than nothing at all. There are so many variables affecting skating force (including stylus dimensions and shape, record material, tracking force, playing radius, recorded velocity, arm offset angle, and others) that precalibrated anti-skating adjustments can provide only a rough guide to the user.



One way to set anti-skating compensation is to play a record which is so heavily recorded as to mistrack and distort, and adjust the anti-skating until the distortion is equal in both channels. In the long run, this will ensure that record and stylus wear are equalised between the two channels. As has been implied, precise adjustment of the corrective anti-skating force is neither possible nor necessary, and therefore the manufacturer's recommended settings should usually serve.

Successful anti-skating compensation methods include levers, hanging weights, springs, and magnetic repulsion. None

Paul Anka carries sound insurance.



Paul is a true one-of-a-kind on the contemporary music scene. What performer today could write such pop classics as "My Way" and "Jubilation" —and then perform them with a song style and stage presence that's known and loved from Caesars Palace to San Juan? Small wonder that Paul takes vocal sound systems seriously, and no matter where he appears, the system he takes is the Shure Vocal Master. Even though he can afford any system made, he carries and uses the Vocal Master, even in preference to costly built-in "house systems." Why? Because the Vocal Master gives him recording studio control over live performances . . . because the control console provides ease of operation and feedback control . . . and because it is expandable to provide enough amplification and power to cut the largest showplaces down to size. Added to all these features is reliability that's already legend among professional entertainers:

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RECORD PLAYERS — CONT'D

appears to be fundamentally superior to the others.

Cuueing, or placing the stylus in the desired record groove, requires care, a certain amount of skill, and well-designed finger lift on the tone arm. A heavy-handed technique may damage the delicate stylus structure, while too light a touch can permit the tone arm to escape your grasp and damage a record. Care and skill are within the user's control, but finger lifts vary widely in their usefulness. If the arm tends to "get away from you," possibly skittering across the record or dropping to its surface, the trouble may lie with a poorly designed finger lift.

Almost all record players and separate tone arms have a cueing lift device designed to raise and lower the pickup more gently than is usually possible by hand. Most have a damped descent, preventing an excessively rapid lowering to the record; the better ones are also damped during the lift (this prevents "bounce" that can sometimes shift the lateral position of the pickup).

A common weakness of cueing systems is the tendency of the arm to drift toward the outside of the record during descent, under the influence of the anti-skating force. The better ones are free of this effect, but zeroing in on a precise portion of the record is usually easier by hand than with a cueing system, because of the difficulty of estimating the lateral position of the pickup when it is raised appreciably above the record surface.

• **ADVICE TO BUYERS: Although most tone arms provide for some sort of anti-skating compensation, the effects of anti-skating — or lack of it — are rarely audible. Unless you are particularly charmed by the theoretical aspects of such features, it's probably wiser to be more concerned about the handling qualities and "feel" of a tone arm. Is the finger lift easy to use? Does the cueing function operate smoothly and without excessive "drift" when the arm is lowered or raised? Is the layout of the turntable such that there is easy physical and visual access to the arm when it is necessary to perform some delicate manoeuvre with it? In the long run, these purely practical considerations will probably prove more important in determining your ultimate satisfaction.**

RECORD CHANGERS

Although a record changer (or automatic turntable) is equipped with a special record-handling mechanism, this usually has no bearing on its basic performance as a record player. In most respects an automatic turntable can be considered simply a turntable and an integral arm installed together on a motorboard. Each of these components can be judged on its own merits, although the advantages of one must sometimes be balanced against the shortcomings of the other because the two are operationally inseparable.

The changer section of an automatic turntable really functions only at the beginning and end of a record. Near the end, the trip mechanism comes into operation by either sensing the tonearm position or its increased angular velocity as the stylus moves into the spiral groove.

In most cases, the tone arm must apply some minimum sideways force to operate the trip mechanism. This force is scaled according to the normal range of tracking force for which the arm is designed, and in the better models it is a very small fraction of a gram. If the cartridge selected is suitable for the range of tracking forces recommended by the automatic turntable manufacturer for his tone arm, the trip mechanism should never give any trouble.

The record stack on a changer (as many as six to ten discs) is usually supported entirely by the centre spindle, which also contains the fingers and expanding collar used to release only the bottom record of a stack. The better players have interchangeable spindles: the tall automatic-play spindle that supports the record stack and a short manual or single-play spindle that rotates with the record.

In every case, the longer automatic spindle is stationary, and many people are concerned that this might erode the record material around the centre hole as the disc turns, enlarging the hole and perhaps permitting the record to shift off centre on the platter. This may have been a problem in the days of 78-rpm records, which were made of shellac and were easily chipped or worn, but I doubt that any modern record changer will significantly wear the centre hole of a vinyl record.

At one time it was widely suspected that changer mechanisms contributed to record-groove damage and wear. This supposedly happened because the change cycle dropped stationary records onto spinning ones, causing their grooved surfaces to grind together and imbed dust and similar debris in each other.

While there was never any real evidence that this took place (the grooved portions of stacked records are kept from coming into contact by the greater thickness of material at the centres and outer edges of the discs), most manufacturers of automatic turntables have taken pains to make the changing cycles of their machines as gentle as possible.

Today there is rarely reason to suspect normal changer operation of damaging discs in any way. However, it's certainly true that using the changer function of an automatic turntable prevents the cleaning of each disc side just before it is played, which many fastidious audiophiles prefer to do.

Record changers still are subject to occasional "hang-ups" of records on the dropping mechanism, usually because of out-of-tolerance record-hole or thickness dimensions. This fortunately rare occurrence is one of the small sacrifices one must make in exchange for what is considered by some to be the very considerable convenience of being able to play a number of records without interruption.

Several years ago, there was a world-wide standardisation of the vertical tracking angle of phono cartridges. This in an angle determined by the internal geometry of the cartridge, as well as its mounting relative to the record surface. The effect of an appreciable vertical tracking angle error is to increase second-harmonic distortion, although errors of a few degrees are unlikely to produce audible effects.

Since the vertical tracking angle changes as the angle of the tone arm to the record surface (as viewed from the side) changes, it varies during the playing of a stack of records.

Manufacturers of automatic turntables recognised this "problem" and soon came up with a variety of "solutions." (The quotes are used because the "problem" is certainly the least of those affecting phonograph reproduction.) The typical solution involves permitting the operator to conveniently shift the vertical angle, switching it to the correct position for the centre record of a stack in automatic operation or for a single record during single-play operation. This can be done either by moving the entire tone-arm pivot post up and down, or by simply tilting the cartridge forward or back on its mountings.

Such features have another advantage in addition to their theoretical one. Certain cartridges are so shaped that the rear of their plastic bodies can contact the record under some playing conditions, and the extra "tilt" of the correction device can help the cartridge to avoid brushing against the record.

Even when playing single records, the automatic tone-arm indexing of a record changer can be a great convenience. Many people choose automatic turntables principally for that reason rather than because they habitually play stacks of records. The automatic single-play unit can often be an ideal solution in such a case. In effect, it does everything an automatic record changer does except change records.

Pushing a lever or button starts the motor and indexes the arm, and after play is over the arm returns to rest and the motor shuts off.

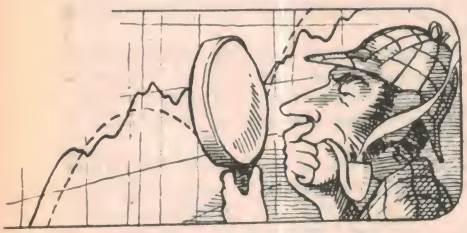
There are several lesser degrees of automation in single-play turntables. Some, especially the less-expensive models, simply shut off without returning the arm to its rest. In general, there is as much variety in features, performance, and price among single-play automatic turntables as among record changers.

Neither has any fundamental performance advantage, nor is there a clear division by price. Broadly speaking, you get what you pay for in either type. But of course you may find yourself paying a great deal more for a unit with only slight performance advantages.

• **ADVICE TO BUYERS: Think hard about your record-playing habits before sacrificing**

RECORD CHANGERS

any desirable turntable feature — even aesthetic appeal — for the sake of a changer mechanism that may never be used. Then, if a changer is still your choice, by all means run through a stack of records several times in the store, making sure that the number of records accommodated is sufficient, that the change cycle is gentle and not annoyingly long, and that there are no hang-ups in getting records on and off the spindle. Some automatic turntables are so designed that interrupting the change cycle — even grasping the arm when it is being indexed — will not harm the mechanism. This might be a feature worth looking into if there are small children around the house, or people who are uncomfortable with automatic devices.



PERFORMANCE SPECIFICATIONS

The principal performance specifications of a record player — rumble, wow, and flutter — must be carefully interpreted when comparing the ratings of competing units. The various measurement techniques in current use can yield very different numerical test results on the same piece of record-playing equipment.

Rumble is measured as the low-frequency output of a phono cartridge playing a silent, unmodulated groove. It is expressed in decibels below a reference level — usually the output of the cartridge when it plays a groove recorded with a standard test tone through an RIAA equaliser.

The basic measurement (unweighted) does not take into account the relative audibility of different rumble frequencies. For the same level, a 30Hz rumble is far more audible than one at 20Hz or lower frequencies. Rumble measurements are often weighted by reducing the effect of the frequencies below 500Hz at a rate of 6dB per octave of falling frequency to give a better correlation with subjective effects.

When comparing rumble measurements, be sure they were made in the same way. Unweighted rumble levels of —35 to —40dB are typical of the better automatic and single-play turntables. A few of the best (usually those with the most sophisticated drive systems) can measure as low as —45dB. Moderately priced record changers may have a rumble level of —25 to —30dB, which does not automatically disqualify them for use in a moderately good music system! At a reasonable listening volume, with speakers whose response falls off below 50Hz or so (and that includes most compact systems and many rather large ones), a —25dB rumble level may not be noticeable.

Weighted rumble usually measures —50dB or lower, with most good turntables being in the vicinity of —55dB. The unique advantage of the direct-drive system, whose rumble is confined to subaudible frequencies, is illustrated by the fact that we have measured some of them (weighted) as being in the —63 to —66dB range.

A similar situation exists with respect to the short-term inconsistencies of platter speed called either wow or flutter (depending on the rate at which the speed wavers). The audibility of these phenomena is a function of their rate as well as their amplitude Depending on the weighting curve of the measuring instrument and its other characteristics, the test results can vary over a wide range. Our own flutter measurements are essentially unweighted "RMS" (the old NAB broadcast standard), and will usually produce somewhat higher numbers than those quoted for weighted measurements.

To further confuse the issue, individual listeners differ widely in their ability to detect — or to be annoyed by — flutter. Most audiophiles would not find 0.15 per cent flutter (as we measure it) particularly objectionable, unless it happened to occur at a low rate (wow). This percentage is typical of good cassette recorders on the market, which are widely considered to achieve high-fidelity performance, as well as many of the medium-price automatic turntables.

However, some critical listeners find even 0.1 per cent flutter quite noticeable, even though most people would consider it insignificant. The best turntables have flutter as low as 0.04 per cent, which is not likely to be detectable by any listener.

Most of the other record-player specifications and parameters (such as tracking error, pivot friction, arm resonance, anti-skating accuracy, etc) have little or no effect on the listening quality of a record player much of the time. They are best judged subjectively, since measurements are either very difiicult to make in a standardised manner, or they would not lend themselves to ready interpretation by the user.

• ADVICE TO BUYERS: The lack of standardization in rating systems and test procedures makes comparison of manufacturers' specifications a chancy thing. Therefore, along with test reports published in magazines such as this one, the shopper must depend upon in-store evaluations to determine the amounts of wow, flutter, and rumble in a turntable. Always use speakers with adequate bass response when listening for rumble. And again, try to use the phono cartridge you plan to buy since unfavorable tone-arm/cartridge combinations can generate spurious low-frequency signals or interact with the mechanical characteristics of a record in a way that may affect the performance of the rest of the system.

Power amps may go digital

Digital microcircuits have brought about incredible size reductions of electronic calculators and minicomputers in recent years. It now seems possible that digital design concepts could be used to reduce the size and bulk of the Hi-Fi amplifier.

Virtually all entertainment electronics — TV, radio, Hi-Fi — currently employ linear circuits — ie circuits that amplify and control continuous signals. However, a California-based firm, Infinity Systems, is now readying a compact 250W per channel stereo amplifier that employs digital output stages. The 250W power amplifier boards are a mere three inches square, and lack the large metal heatsinks required in conventional amplifiers. This is because digital operation, also known as class-D, is 90pc efficient in contrast to an efficiency of 40pc for linear amplifiers which dissipate the power loss as heat.

FINAL CHECKS

Although you will not be able to make any measurements on the turntables or arms on a dealer's shelves, there are a few simple operational checks that can help you to arrive at the right decision. Beforehand, it is a good idea to read a number of magazine equipment reviews to gain some background and general guidance, a "feeling" for the subject itself, even if you do not plan to buy one of the reviewed models.

Basic questions such as cost, automatic versus non-automatic operation, and the like are matters of individual choice.

Unlike most audio components (the tape recorder being another exception), there is a close and direct relationship between a record player and its user. Regardless of how well it performs its basic functions, a record player that emits strange sounds, drops records with a resounding "thunk," or defies your best efforts to handle and use its tone arm without incurring stylus damage is not likely to prove satisfactory in the long run.

When you find a unit whose specifications and features appear to meet your requirements, practice using it in its various operating modes before coming to a final decision. Every record player has its own peculiar characteristics, as does every audiophile. Only grief can result from an incompatible pairing of the two.

It is easy enough to assess the flutter and rumble of a turntable as it sits on the dealer's shelf. Select a gentle piano recording to evaluate the approximate flutter of a turntable.

A quietly recorded passage is suitable for an audible rumble check, but you should also conduct a visual inspection of the speaker's woofer cone when playing this band at a rather high volume-control setting (and possibly with some bass boost provided by the tone controls as well). Such a "visual rumble" test may reveal very low frequency rumble that might not be audible under showroom conditions. Try this test first with the best turntable on display (preferably one with direct drive) to establish the residual rumble levels in the record groove, and then try it out on the turntable you are considering buying.

Any listening evaluation of a record player should be made with ancillary equipment at least as good as that you plan to use at home. The better it is, the more likely it will be to reveal the true character of the record player — its strong points as well as its weaknesses.

The Acid Test.

"Hey! Watch out! The needle's right over into the **red**!"

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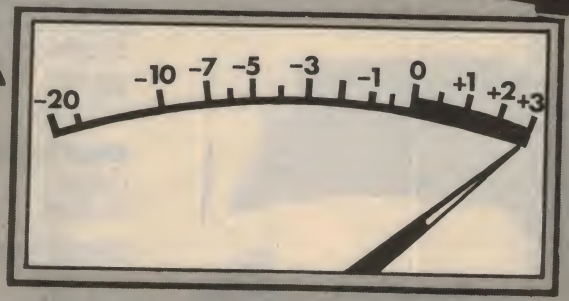

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KC6MX	8W RMS	50Hz-20kHz
C60	10W RMS	35Hz-7500Hz
C60X	10W RMS	30Hz-17kHz
C80	20W RMS	35Hz-8kHz
C80X	20W RMS	35Hz-20kHz
C100	20W RMS	40Hz-11kHz
C100X	20W RMS	40Hz-20kHz
C12P guitar	30W RMS	55Hz-10kHz
C12P woofer	30W RMS	35Hz-10kHz
C12PX wide range	30W RMS	35Hz-13kHz
C12PX guitar	30W RMS	55Hz-13kHz
12U50	50W RMS	25Hz-11kHz
12UX50	50W RMS	40Hz-13.5kHz
MIDRANGE		
C6MR	20W RMS	450Hz-6600Hz
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TWEETERS		
X20 horn	—	3kHz-30kHz
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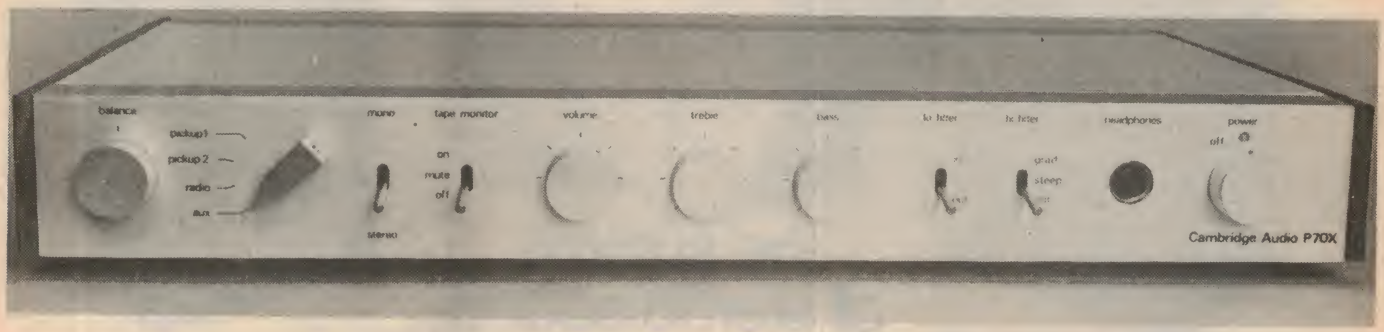
AR68

Cambridge P70X stereo amplifier

At only two inches thick, the Cambridge P70X must be the "thinnest" amplifier on the Australian hifi market. But its modest dimensions enclose a real "power-house" of an amplifier, with 35 watts per channel and quite a range of facilities.

Cambridge Audio have been manufacturing amplifiers for at least six years now at Huntingdon in England. But it was not until late September of this year that they became available in quantity in Australia through the newly appointed distributors, Export Exchange Pty Ltd.

No doubt, the first question which must arise in the prospective user's mind is "How do Cambridge Audio manage to get 35 watts RMS or more per channel out of such a small chassis?" After all, the P70X dimensions are 420 x 270 x 55mm (W x H x D) including knobs and feet. Weight is just 5.5kg.



Clearly, to get as much power as Cambridge claim, a large power transformer is required. And Cambridge do use a large transformer but it is unlike that used in any other amplifier we have reviewed in the past. The transformer is a large toroidal unit completely covered in insulation tape and held serurely in place by an aluminium disc-shaped clamp.

Besides having a very low profile and hence allowing a shallow chassis, the toroid has advantages over a conventional transformer — high efficiency and low leakage flux (hum radiation) without any need for expensive copper straps. On the minus side, the toroidal transformer must be quite expensive to make; but the user is not likely to be concerned about that.

Having assured the potential buyer that it is indeed possible to build a powerful amplifer into a shallow chassis we can go on to describe its external features.

Aside from the shallow format, the styling of the Cambridge P70X is relatively unassuming. The front panel (and back panel) is an aluminium extrusion with a subdued "scratch-grain" finish. Five knobs are used for Balance, Volume, Bass, Treble and Power. These knobs are all smooth in action but we would prefer a knurled rather than smooth circumference to give better grip.

Four miniature toggle switches are used for the following functions: Tape monitor, stereo-mono switch, low filter and high filter. The tape monitor facility has a number of interesting features. For a start, it is placed in the circuit after the volume and tone controls and the low filter.

This means that the tone controls can be used to make alterations to the signal to be recorded, which is not possible on most other amplifiers. The low filter can also be used to cut out undesirable turntable rumble from the recording while the volume control is used to make the preliminary recording level adjustment. If you wish to silence the amplifier while recording is in progress, just flip the Tape Monitor switch to its "Mute" position. This feature is also handy when answering the telephone or during momentary instructions to your spouse regarding refreshments which are necessary during a long listening session. Women's Lib will be pleased!

When the Tape Monitor is switched in to listen to the signal actually recorded on tape, the former controls are inoperative so that you really do listen to what is on the tape. A level control on the rear of the unit enables you to set the playback sound level. At the same time, the high filter can be switched in to reduce tape hiss.

While keen tape recordists will be happy with the facility for recording, they may not like the playback arrangement since it means you cannot use the tone controls when listening to tapes unless the recorder is plugged into the Auxiliary input socket. Still, you really can't have it both ways and the Cambridge answer to the tape recordists' desire to be able to use tone controls while recording is certainly a practical way out.

Two settings are provided for the High filter: Gradual and Steep. In the Gradual setting, the rate of attenuation is a modest 4dB/octave and the actual attenuation at 10kHz is about 3dB. In the Steep setting, these figures are increased to 8dB/octave and 6dB respectively. Above 20kHz, the Steep filter modes really do become steep but the effect will be inaudible.

Operation of the Low filter also has a rather gradual effect, giving minus 2dB cut at 100Hz and about minus 20dB cut at 10Hz. While both the High and Low filters are useful, it would seem preferable that the Low filter be made a whole lot steeper, say at least 18dB/octave below 30Hz with a sharp turnover and not switchable. At the same time, the High filter could be made steeper to give a more useful reduction in hiss on poor recordings.

No loudness facility is provided. It seems that at least one hifi manufacturer has realised that loudness compensation is largely a delusion.

A standard headphone socket is provided on the front panel for phones of 8 ohms impedance or more. Use of this socket automatically disconnects the loudspeakers.

Instead of the normal push-button or toggle switch, a rotary switch turns on the power. An unobtrusive pilot light above it indicates when power is actually applied.

On the rear panel, pairs of RCA phono sockets are provided for two cartridge inputs, radio and auxiliary inputs and tape monitoring connections. We found these paired sockets a little too close together when plugs with plastic moulded housings were used — we had to cut the plastic away to allow them to be used.

One of the cartridge inputs has a sensitivity of 100mV and is RIAA equalised for connection of a ceramic pick-up. This would be handy when the user wanted to employ the system at a party, where he might be worried about using an expensive magnetic cartridge.

A five-pin DIN socket parallels the phono sockets for the Tape monitor facility. An additional DIN socket is provided with preamplifier outputs and amplifier inputs. This enables the P70X to be used in systems with electronic cross-over networks, four channel decoders or whatever. In normal use a bridging plug must be inserted into this socket otherwise the amplifier will not work.

Banana jack sockets are provided for one pair of loudspeaker systems. A pair of two pin mains sockets, of the American type, are provided for powering a tuner and turntable. One is switched, one is not.

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THE INTEGRATED STEREO AMPLIFIER

The TA-1150 features abundant power, low distortion power amplifier; Direct coupled circuit; Two tape recorder inputs. **Continuous RMS power output:** At 20 Hz-20 kHz 30 W + 30 W (8 ohms) both channels driven simultaneously. **Dynamic output (IHF):** 150 W (4 ohms) 100 W (8 ohms). **Harmonic distortion:** Less than 0.2% at rated output. **Frequency response:** 12 Hz-150 kHz $^{+0}_{-2}$ dB at 1 watt output. **Power requirements:** AC 100, 120, 220 or 240 V, 50/60 Hz. **Dimensions:** 400 (W) x 149 (H) x 316 mm (D). **Weight:** 8.3 kg.

TURNTABLE

The PS-2250 features direct drive turntable, Sony's exclusive AC servo drag cup motor, Rumble-free performance with lowest flutter and wow. **Turntable:** 31 cm (12¼"), aluminized-diecast. **Speeds:** 33⅓ rpm and 45 rpm. **Drive System:** Direct drive system. **Power requirements:** AC 240 V, 50 Hz. **Flutter and wow:** 0.04% wrms. **Signal-to-noise ratio:** 58 dB (JIS), 67 dB (DIN) **Dimensions:** 490 (W) x 185 (H) x 395 mm (D). **Weight:** 11.3 kg.

THE SPEAKERS

The SS-7330 features newly developed stereo speaker system using revolutionary "Ultra Linear Magnetic Path," 3-way, 3-speaker system. **Speaker system:** Bass reflex 3-way type. **Speaker:** Woofer 30 cm (12") cone type, Mid-range 12 cm (5") cone type. Tweeter 2.5 cm (1") dome type. **Maximum power handling capacity:** 100 W. **Dimensions:** 390 (W) x 636 (H) x 310 mm (D). **Weight:** 22 kg each.

SONY

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Cambridge P70X

Removing the small timber side panels enables the top to be removed also and reveals the interior of the P70X, which is divided into two sections. One compartment houses the large toroidal transformer referred to above plus the power supplier rectifier and large filter capacitors mounted horizontally.

A large PC board almost completely occupies the second larger compartment and it accommodates the major portion of the amplifier circuitry. A small board mounted vertically on the inside of the rear panel accounts for the rest of the circuit. A shaft for the Source Selector switch runs across the chassis to a switch wafer section on the latter board. Most of the wiring is bound into a thick harness to keep it neat and tidy.

Plastic encapsulated silicon power transistors are used in the output stages of the P70X and these are clamped to a common L-shaped heavy-gauge aluminium heatsink along with the transistors which provide thermal compensation of the quiescent current. This heatsink is mounted on the chassis floor so that in effect, the chassis acts as a large heatsink.

There are quite a number of interesting circuit features in the P70X. For a start, all the input signals are coupled to a Darlington emitter follower stage with each input load condition precisely provided by a resistor, eg, in the case of the magnetic cartridge input the resistor is 47k. The apparent reason for this input stage is that it is aperiodic, ie, its gain and particularly its input impedance is not frequency dependent.

A constant input impedance regardless of frequency is particularly important for magnetic cartridges. If it is not constant their frequency response can deviate quite widely from the desired characteristic. On the other side of the coin, a Darlington emitter follower stage is not ultimately as quiet as a properly optimised common emitter input stage.

Following the input stage is a two-transistor direct-coupled pair with the volume control in the negative feedback loop rather than merely as a simple attenuator. By adjusting the gain of this stage, the input overload margin is also adjusted. When the volume control is set for minimum gain, the overload margin is at a maximum. In practice, this method combined with the fact that the stage has a flat gain (no equalisation) gives enormous overload margins.

For example, the magnetic cartridge input has a nominal sensitivity of 3mV RMS at 1kHz for full output. We measured the maximum signal before overload occurred at 2.5 volts (yes, volts!) regardless of the input frequency.

Stages following the volume control provide equalisation, tone controls and filters.

The power amplifier stages consist of ten transistors for amplification plus additional transistors and diodes for overload protection. The input stage of the power amplifier is a differential pair which sets the DC offset voltage at the output at very close to zero and allows the loudspeakers to be direct-coupled.

Besides having a system of electronic protection to remove the signal drive in the case of short term overloads, the P70X also has a relay which disconnects the loudspeakers in the event of damage to the amplifier, gross overheating or long term overload. In addition, the relay disconnects the loudspeakers at switch-off and provides a short delay before connecting them at switch-on.

The relay also mutes the loudspeakers momentarily whenever the Selector switch is moved to a different setting. All this is done to ensure that no loud transients are heard via the loudspeakers. In short, the P70X shows a lot of evidence of careful design.

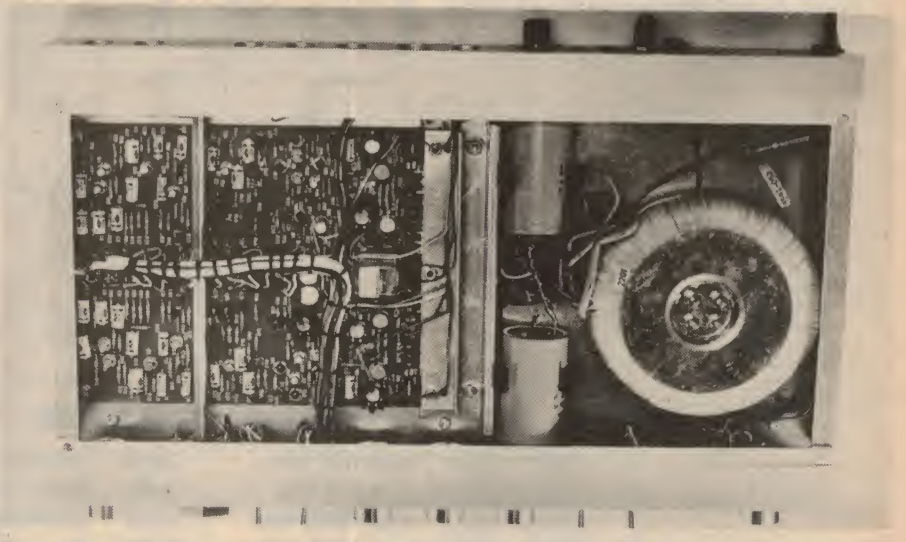
One point we did find worrying was the recommended mains input voltage for the unit. This is stated to be 220VAC twice on the power cord, twice on the rear of the chassis and once on the power transformer. Yet the well-written manual states that it is "preset within unit to accept 240V." If the unit has been designed to suit 220V, which seems likely for European conditions, then normal characteristics checked out as specified and the damping factor at all frequencies was almost unmeasurably high. A figure of better than 100 was claimed for 8 ohm loads.

Harmonic distortion was hard to measure because of the limiting factor of residual noise. We did verify that it was less than 0.1 pc for all powers up to rated output at frequencies within the audio range.

One sobering point was that we finally "blew" one of the output transistors during testing for instability, after our rather stringent previous tests.

It did not worry the local distributors, however. They promptly cabled the manufacturers in England and queried how this could happen. Apparently the manufacturer quickly did some tests on a sample amplifier but was not able to duplicate the same unstable condition.

Export Exchange Pty Ltd repaired the amplifier and resubmitted it to us for further testing. We are happy to state that we were unable to "blow" it up on the second occasion. It stood up to all the abuse we could think of. And it did not show any signs of instability at all.



Crosstalk ranged from minus 45dB at 10kHz to 60dB at 100Hz. Tone controls and filter variations in Australian 240/250V mains could take it above 260VAC.

If this is the case, then it seems likely that some components within the unit could easily have their ratings exceeded. The local distributors have informed us that they are aware of the problem and have contacted the manufacturers for clarification and modfification if necessary.

Rated power of the P70X is 35 watts RMS per channel into 8-ohm loads and 21 watts RMS per channel into 15-ohm loads. Into 8-ohm loads, we measured 50 watts RMS per channel with both channels driven; into 4-ohm loads or 16-ohm loads, we measured 32 watts RMS per channel with both channels driven.

These measurements were made using a closely regulated mains power supply set to 240V. The figures appear to confirm our remarks about mains voltage.

After 15 minutes continuous operation at 50 watts per channel, the chassis became hot but not too hot to touch. It was interesting to note that the surface temperature of the transformer was higher than that of the output transistor heatsink.

Frequency response at one watt was within 3dB from 6Hz to 50kHz. Signal to noise rations referred to 50 watts were minus 79dB for Auxiliary inputs and 60dB for magnetic cartridge input. Both these figures refer to short-circuit inputs.

About the most dramatic reaction we could get to any of our overload situations, such as full drive into a short circuit, was that the relay disconnected the loudspeakers. All that has to be done then is to switch off the amplifier for a few seconds and then switch on again to restore normal operation.

The local distributors also state that they keep a full service record on every piece of Cambridge equipment that they sell. So service facilities appear to be well organised.

Naturally, we had a long listening session with the amplifier before it was tested. This brought to light no problems and confirmed that it had plenty of power in reserve for normal use. No doubt the P70X will sell like hotcakes on a winter afternoon. And there is available a matching stereo FM tuner that can be stacked on top.

Recommended retail price of the Cambridge P70X is $385 including sales tax. All Cambridge products are covered by a five year warranty from the date of retail sale.

Cambridge Audio products will be available from selected hifi outlets throughout Australia. For further information, contact the Australian distributors, Export Exchange Pty Ltd, 84 Pacific Highway, North Sydney, NSW 2060. (L.D.S.)

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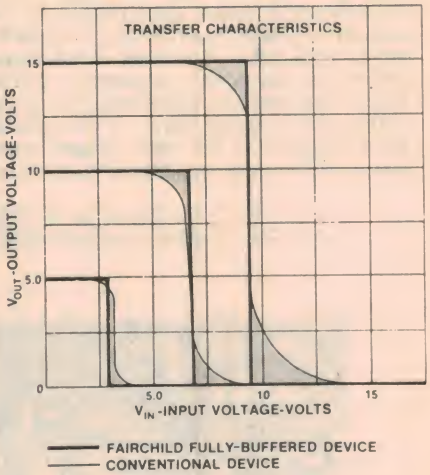

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34030	Quad Exclusive OR Gate	340163	4-Bit Binary Synchronous
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Heathkit Model AA-2005 4-Channel Amplifier

A recent addition to the Heathkit line-up of electronic kitsets is the Model AA-2005 4-Channel Amplifier. Rather than undertake the time consuming task of assembling the kit, we have decided to review the amplifier as purchased by the home constructor — that is, as a kit of parts.

The Heathkit Model AA-2005 is a complete quadraphonic amplifier with built-in SQ decoding circuitry and is also capable of accepting external discrete four channel signals, either from a tape recorder or from a decoder. Reading through the usual detailed instruction manual, the first thing that struck us is just how similar this amplifier is in terms of specifications and concept to our own Playmaster 140. In fact the Heathkit AA-2005 could be regarded as an alternative to the Playmaster 140, provided of course that you are prepared to pay the extra dollars for ease of construction.

There are, however, some important differences between the two amplifiers. The first, most obvious, difference is that Heath have duplicated the tone control circuitry for the rear channels, providing independent bass and treble controls for the front and rear channels. The second major difference is that instead of using independent volume controls for the front and rear channels and a left to right balance control, Heath have opted for four independent level controls and a single master volume control.

Front panel control facilities are laid out in a straightforward manner. These include, from left to right, the bass and treble controls for the front channels, the bass and treble controls for the rear channels, and a master volume control. To the right of the volume control are the four independent level controls, grouped together. Beneath these controls, from left to right, are the front and back headphone sockets, a group of six push on—push off switches for selecting power, speakers on / off, mono, stereo, matrix and four channel, and a second group of four switches for selecting tuner, auxiliary, tape or phono inputs.

For a complete 4-channel amplifier, the circuitry of the Heathkit Model AA-22005 is relatively simple. For example, the magnetic cartridge equalisation preamplifier consists of a single integrated circuit with a handful of peripheral components. The tone control circuitry is conventional, employing the well known Baxandall feedback configuration.

Conventional also is the power amplifier circuitry. The input stage of each power amplifier is a differential pair that maintains zero DC voltage at the output of the amplifier. Output from the differential pair is fed to the usual class-A voltage amplifier stage with bootstrapped collector load and thence a quasi-complementary emitter follower output stage.

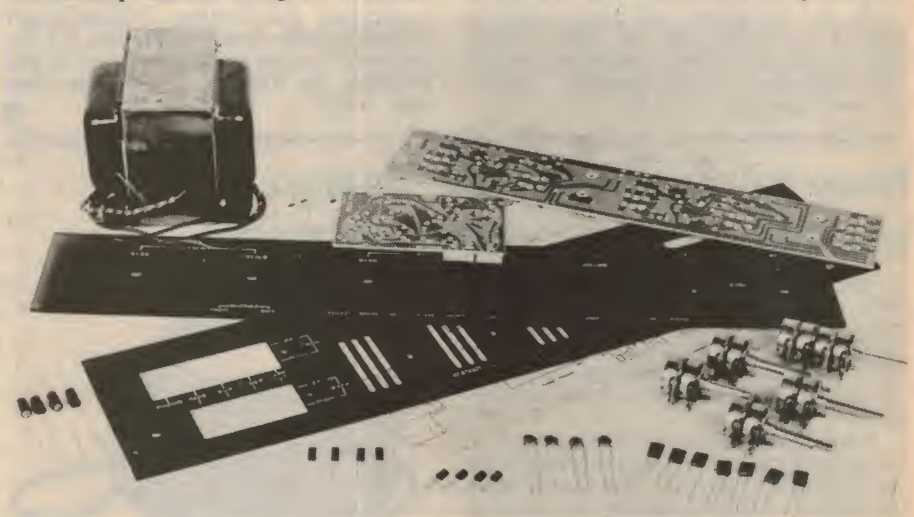
The SQ matrix decoder circuit is identical to that used in the Playmaster 140. However, unlike the Playmaster 140, the circuit used here immediately precedes the tone control circuitry. This arrangement is necessary because of the independent tone control circuitry for the front and rear channels.

Large electrolytic capacitors, 10,000uF, are are used in the power supply which has balanced positive and negative rails. The supply to all parts of the circuit other than the power amplifiers is regulated. The power supply is unusual in that an integrated circuit is used as a voltage regulator in the positive rail, whilst discrete components are used in the negative rail. A delay circuit in the negative power supply rail delays the turn-on of the tone control circuitry when power is initially applied. This is to protect the power amplifier stages from damage due to transients.

The power transformer itself is quite massive and is well shielded. Shielding takes the form of two steel end plates and a steel strap that runs right around the outside of the laminations. In fact, the transformer would tend to make the completed unit quite heavy.

From a constructional viewpoint, the design of this amplifier appears to have been well thought out. Most of the wiring and componentry is contained on no less than 10 printed circuit boards (PCBs). These include one each for the magnetic preamplifier, the SQ matrix decoder and tone control circuitry, two for the tone control preamplifier circuitry (one for the front channels and one for the back), and one for each of the four power amplifiers. With the exception of the tone control board, these boards are all accommodated on one large master board via plug in receptacles.

The latter feature should prove particularly attractive to the home constructor in that it eliminates a great deal of interwiring between boards. However, this design philosophy does not end here. All the push on / push off mode and program selector switches are mounted directly on the master circuit board. Similarly, the bass and treble control pots and the master volume control are soldered directly to the tone control board. The four independent level controls have to be wired separately.



A selection of components from the Heathkit 4-channel amplifier kit.

The plastic power output transistors are mounted directly on foil side of the power amplifier boards. Heatsinking takes the form of large, flat heatsinks stood off the power amplifier PCBs by metal spacers and by the power transistors to which they are bolted. The heatsinks are in turn bolted to the rear panel, thus serving to secure the power amplifiers in position. The remaining plug-in circuit boards are secured by a metal retaining plate held in position on two metal spacers attached to the master circuit board.

The pre-punched aluminium chassis

consists of a number of sub-assemblies held together by small machine screws. Generous ventilation slits are provided at the rear of the chassis to ensure adequate cooling of the heatsinks. An attractive etched, black perspex panel is used to dress the front panel. Wooden side panels are supplied to further enhance the appearance of the completed amplifier.

The PCBs are of high quality and are pretinned. In order to eliminate constructional errors, the boards are all coded. And of course, there is the famous Heathkit construction manual with its detailed step by step instructions. All one really needs to construct this amplifier is the ability to solder!

In addition to the constructional and circuit details, the assembly manual provides a chapter on troubleshooting, and gives detailed instructions on the installation and operation of the amplifier. As with all Heathkit projects, the kit is backed by the Heath Company's "Factory Repair Service" warranty.

Specifications of the Heathkit AA-20005 4-channel amplifier bear a marked similarity to the Playmaster 140 (see December 1973). Power output is quoted as 15W per channel continuous into 8-ohm loads, or 20W continuous into 4-ohm loads. Signal / noise ratio is 60dB for phono input and 70dB for the tuner, auxiliary and tape inputs with respect to 15W. Magnetic cartridge sensitivity for full power into 8-ohm loads is quoted as 2.2mV into 49k, other inputs 200mV into 100k. Power bandwidth (minus 3dB points for the rated distortion of 0.5pc) is rated from 5Hz to 30kHz.

All in all, we could find little to fault this well presented kit. However, the small moulded 2-pin mains plug supplied does warrant criticism. This is something that we have complained about many times in the past. Australian constructors who purchase the kit are advised to remove the 2-pin plug and fit an approved 240V Australian plug.

About the only other criticism that could be made is of the control knobs. No, I'm not nitpicking! The knobs are cheap plastic push-on types and are totally out of keeping with the otherwise high standard of presentation. In addition, the knobs are too small to be used conveniently. In fact, the purchase of some larger, more attractive brushed aluminium knobs from a separate source would make a worthwhile improvement to this amplifier, both from an appearance point of view, and for ease of control.

These thoughts aside, our impression of the Heathkit Model AA-2005 is that it is a well thought out and attractively presented kit. At a recommended retail price of $294, including sales tax, it is hardly cheap. However, if you want an easy-to-put together four channel amplifier kit complete to the last nut and bolt, then the AA-2005 is worth considering.

Those readers who are interested in obtaining a kitset for the Model AA-2005 4-Channel Amplifier should contact the Australian distributers, Schlumberger Instrumentation Australia Pty Ltd, PO Box 138, Kew, Victoria 310. Also at Suite 7, P & M Building, 134 Willoughby Rd, Crows Nest 2065. (G.S.)

New Sony headphone design use electret transducer elements

The Sony Corporation has developed a new sound conversion element which it plans to use in future loudspeaker and headphone designs. Known as the Uni-Electret, the new element has a simple structure, and is capable of mass production.

Conventional electret elements consist of a high polymer sheet vapour-deposited with a metal film. A positive electric charge is produced on the high polymer film side, and a negative charge on the metal film side. The Uni-Electret differs from this approach, however in that a positive electric charge only is induced on the high polymer film side.

When designing electrostatic speakers and headphones, it is necessary to provide a push-pull electrode structure to prevent distortion if the amplitude of the vibrating film is increased to obtain a higher sound pressure level. In the past, this has made it necessary to design complex structures. This in turn led to mass production and quality control difficulties.

The Uni-Electret, on the other hand, has a simple structure, and, in common with conventional electret headphones, does not require an external power supply. However, unlike conventional electret headphones which use a round vibrating film, the new ECR-500 headphones using the Uni-Electret have a pentagonal film with unequal sides to minimise resonances. In addition, the power handling capability has been increased over that of other electret headphones.

The Model ECR-500 Uni-Electret condenser headphones with the new sound conversion unit.

According to Sony, the new Uni-Electret sound conversion element offers the following advantages:

- it forms a uniform, high density electric charge (about three times greater than that of conventional electrets);
- it is stable in operation and has a long service life;
- it is capable of mass production with uniform quality.

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No compromises accepted

GX600DP GX400DSS

AKAI

GX-600 SERIES
Available in 4 track 2 channel, with or without Dolby and in 2 track 2 channel.
Reel Capacity: Up to 10½" reel
Tape Speed: 15 and 7½ ips (±0.8%) (Pro model)
Wow & Flutter: Less than 0.05% RMS at 15 ips
Less than 0.07% RMS at 7½ ips
Frequency Response: 30 Hz to 25,000 Hz (±3 dB) at 15 ips
30 Hz to 23,000 Hz (±3 dB) at 7½ ips
Distortion: Less than 0.7% (1,000 Hz "0" VU)
Signal to Noise Ratio: Better than 59 dB
Erase Ratio: Better than 70 dB
Cross-Talk: Better than 60 dB (monaural)
Better than 40 dB (stereo)
Bias Frequency: 150 kHz
Heads (3): One GX 2 track recording head,
One GX 2 track playback head,
One 2 track erase head.

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For optimum performance from your recorder we recommend BASF tape.

Available from the AKAI Hi-Fi Professionals. Distributed by AKAI Australia Pty. Ltd., Sydney 61 9881, Melbourne 81 0574, Brisbane 44 0171, Adelaide, 74 1162, Perth 25 5177, Darwin 81 3801, Launceston 31 5815.

GX-400 SERIES
Available in 4 track 4 channel, 4 track 2 channel and 2 track 2 channel.
Reel Capacity: Up to 10½" reel
Tape Speed: 15, 7½ and 3¾ ips (±0.5%)
Wow & Flutter: Less than 0.35% RMS at 15 ips
Less than 0.05% RMS at 7½ ips
Less than 0.08% RMS at 3¾ ips
Equalization: NAB curve
Frequency Response: Using low noise tape
30 Hz to 20,000 Hz (±2 dB) zero VU/15 ips.
Distortion: Less than 1% (total harmonic distortion 1,000 Hz zero VU)
Signal-To-Noise Ratio: Better than 58 dB
Erase Ratio: Better than 70 dB
Cross-Talk: Better than 45 dB
Recording Bias Frequency: 160 kHz (±10 kHz)
Heads (4): 2-track recording GX head, 2-track playback GX head, 4-track playback GX head, full track erase head.

News Highlights

MHD generator smashes the efficiency barrier

A blast of hot gas roaring at 3,000 miles-per-hour down a 60-foot-long shock tunnel at General Electric's Space Sciences Laboratory, Valley Forge, Pasadena, has smashed the "efficiency barrier" that has stalled magnetohydrodynamic (MHD) electric power research for the past ten years. The dramatic breakthrough came during a series of closed-cycle MHD tests when 20pc of the heat generated in the shock tube was converted to 1,800kW of electricity in hundredth-of-a-second bursts in a newly developed MHD generator.

The pioneering MHD research, sponsored jointly by General Electric and the US Office of Naval Research (ONR), is an important step in exploring the promise of closed-cycle MHD power as a realistic energy option for the nation's utilities. The Navy is considering MHD applications for simplified, lightweight, and more efficient power and main propulsion systems of the future.

Dr Arthur M. Bueche, GE vice president for research and development, described the achievement of the 20pc efficiency mark as "a major and exciting milestone in an intensive effort to tap the promise of MHD."

Eight percent is the highest efficiency attained thus far by open-cycle MHD — in minute-long bursts in a system that produced some 32MW and was about 20 times larger than the GE-ONR project. Reports from the Soviet Union indicate that 6MW have been produced for day-long periods — but only at 3pc conversion efficiencies.

"Our efforts have proved the scientific feasibility of closed-cycle MHD power generation and shown that it has many potential advantages over the open-cycle approach," Dr Bueche said. "These closed-cycle advantages provide great opportunities for hastening the day when MHD may vastly improve the efficiency of power plants."

It has been estimated that power plants of the future may use an MHD system in conjunction with conventional turbine generators to achieve overall plant efficiencies approaching 60pc compared to today's optimum 40pc.

Electric power is generated by MHD when a high-speed flow of ionised gas — a plasma hot enough to act as a gaseous conductor of electricity — is passed between poles of a magnet. In today's conventional power plants, by contrast, electricity is produced by passing a metal conductor through a magnetic field.

With the success of GE's shock-tunnel studies on closed-cycle MHD, Dr Leo Steg, manager of the company's Space Sciences Laboratory, announced that a parallel development of the closed-cycle MHD project will involve construction of a system that will produce 15MW in minute-long bursts, rather than the split-seconds achieved during the initial research. He explained that this engineering phase calls for a coal-fired MHD test facility, which will use a heat exchanger to raise the temperature of the inert gas to 2,500-3,000 deg F.

Dr Leo Steg (right), manager of the GE laboratory at Valley Forge, Pasadena, and Dr Bert Zauderer, leader of the GE MHD research team, with the 60-foot-long shock tunnel that achieved a new world MHD efficiency record of 20 percent.

"By building on the experience gained in the last ten years in our millisecond shock-tunnel work, we expect to attain our minute-long goal within the next three to four years," Dr Steg added, "and then we plan to move into pilot plant construction and operation."

Work already has started on the engineering phase of the closed-cycle MHD project under the sponsorship of the Electric Power Research Institute and the US Office of Coal Research. Dr Steg estimates that approximately $5 million will be needed during this phase, plus another $25 million to advance to pilot plant construction and operation by the early 1980s.

An open-cycle MHD plant with about the same efficiency as the GE system would cost more than $100 million and would have to be approximately ten times larger, Dr Steg said.

During the engineering phase, the size of GE's generator will be increased five-fold, and coal — instead of a shock tube — will serve as the heat source. Dr Zauderer expects that this machine will operate at a generator conversion efficiency of 30pc, compared to the 20pc milestone just announced.

Computer nabs kidnapper

The central computer in a large on-line bank network based in Tokyo recently turned from dupe to detective and helped nab an ingenious kidnapper.

The accused kidnapper, Masatoshi Tashiro, planned to use the automated network recently installed by the Dai-Ichi Kangyo Bank to solve the perennial kidnapper's dilemma — how to collect the ransom without getting caught.

According to computer crime expert Donald Parker, a senior information analyst at Stanford Research Institute, Tashiro decided to open a cash card account at the bank under an assumed name and demand that the ransom money be deposited there. Then, cash card in hand, he would pay random visits to the bank's 328 remote cash dispensing terminals and withdraw the money $1,200 at a time, the limit available from a single autoteller transaction.

The key to Tashiro's scheme was his discovery — apparently with inside help — that update information on transactions at the remote tellers took 10 to 15 minutes to reach the bank's central on-line files. By the time one of his withdrawals could be detected, he figured that he could be far away.

Having made a few trial runs with his own money, Tashiro allegedly kidnapped actress Yukiji Asaoka, daughter of a famous Japanese painter, and demanded that her ransom be paid into his cash card account.

But Tashiro failed to reckon with the resourcefulness of the bank's programmers and the Tokyo police. The programming staff quickly devised a "patch" for the on-line software that immediately printed out a warning and the location of the terminal Tashiro was using.

Meanwhile, the police diverted 370 patrolmen to almost all the terminals on the network. And when the central computer reported that Tashiro was withdrawing money from an autoteller in Tokyo's main railroad station, police staked out the site and arrrested Tashiro at the exit.

The whole affair caused a sensation in Japan, where newspapers billed the caper as Japan's first "computer crime." Both the police and the bank programmers were awarded government citations for their work in catching Tashiro.

Digital electronics for the blind

Shown in the accompanying photograph are two electronic calculators and a digital voltmeter which have been adapted to give a readout in Braille by the Electronics Division of the School of Mathematics and Physics, Macquarie University, Sydney.

Results from the instruments are read out in Braille one digit at a time by turning a switch or a thumb-wheel. Additional circuitry wired to the display driving circuits is used to decode the numbers from seven-segment form and re-encode it to drive the electromagnets which raise pins in Braille formation. Mini-Sonalerts are used to give error, low battery and overflow signals. These modifications do not affect the normal display readout, which is retained.

The calculators used are adaptations of the Compucorp 320 and the Texas Instruments SR10, whilst the three-range digital voltmeter is based on the Datel DM2000A panel unit. All three instruments are now in trial use at the North Rocks School for Blind Children in Sydney.

Details of the conversion may be obtained by writing to Associate Professor R. E. B. Makinson at Macquarie University.

Long distance coms — via walkie-talkie

Downed pilots and survivors of shipwrecks may someday be able to call for help from any point on the globe with the aid of a tiny short-range radio, a collapsible antenna, and a space satellite.

The dramatic potential of space satellites for search-and-rescue missions was recently demonstrated by Roy E. Anderson, an engineer at the General Electric Research and Development Center, Schenectady, New York, when he beamed a message in Morse code more than 50,000 miles using a modified 5W walkie-talkie and an antenna built upon the frame of a golfer's umbrella. The message, transmitted from Washington DC to GE's Radio-Optical Observatory near Schenectady, New York, was beamed through ATS-3, a NASA satellite in geostationary orbit 22,300 miles above the mouth of the Amazon River.

After receiving the message, Observatory personnel transmitted voice signals back through the satellite to the GE engineer. However, at the moment, voice signals can only be sent one way. By equipping future geostationary satellites with a modified antenna, reliable voice signals could be transmitted from the person in distress to the monitoring station. For the NASA

demonstration, Mr Anderson sent his Morse code signals by depressing the walkie-talkie's "press-to-send" key.

Mr Anderson pointed out that very compact radio and antenna units based on the principle demonstrated could serve a wide variety of other monitoring and locating applications, without interfering with the routine use of the satellite. For example, it would be possible to transmit weather data from buoys or balloons, or even monitor the physical condition and movements of wildlife.

Space crews to produce artificial eclipse

An artificial solar eclipse will be produced by the American and Russian space crews during their joint space mission scheduled for July 1975. The artificial eclipse, to be seen from the Russian Soyuz spacecraft, will be produced in order to photograph the solar corona — the atmosphere of the Sun.

This atmosphere is much fainter than the surface of the Sun. In order to prevent light from the surface from coming through, the Apollo spacecraft will be used as an occulting device to produce the artificial eclipse. The Apollo vehicle will first be aligned towards the Sun. It will then undock from the Soyuz and move backwards towards the Sun whilst an automatic camera aboard the Soyuz takes a series of exposures.

The experiment will allow space photography to be performed of the extended solar corona as well as the spacecraft-associated environment around the Apollo vehicle which could develop from outgassing of sealed compartments, degassing and sublimation of outer structural materials of the spacecraft, or from firings of the attitude control thrusters.

An attempt will be made to correlate the observed coronal structure with surface activity on the Sun, which is to be observed simultaneously with ground-based instruments.

Principal investigator for the experiment is Dr G. M. Nikolsky of the USSR. American co-investigator is Dr R. T. Giuli of NASA's Johnson Space Centre, Houston, Texas. Dr Giuli is also the program scientist for other experiments to be performed jointly with the USSR or unilaterally by the United States.

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NEWS HIGHLIGHTS

Philips to market VLP player

The Philips VLP (video long play) system, thought to be years ahead of its time as far as consumers are concerned, has suddenly become a reality.

The VLP system, which uses "records" to play colour television programs, was first demonstrated by Philips some two years ago. However, at that time, no adequate source of programs was available.

This problem has now been obviated by a recent agreement between Philips and MCA Incorporated, Los Angeles, for the sale of the VLP and compatible discs on the consumer market. Under the agreement, Philips is to manufacture and market the VLP through its worldwide marketing and distributing network, whilst MCA will manufacture and market VLP video disc programs.

MCA has access to a wide variety of entertainment material, including the Universal Pictures film library — one of the world's largest. The company is further expected to produce a variety of new program material especially tailored to meet the VLP's unique characteristics. Other program suppliers are also likely to make suitable material available.

The VLP player itself is similar in appearance to a conventional record player. When plugged into a normal colour TV receiver it is capable of providing some 45 minutes of colour television programs. Program storage is on metallised discs, closely resembling long-play gramophone records. Signal pick-up is via means of a laser beam which scans the information encoded into spiral tracks on the disc.

Bell develops digital radio transmission system

A new link in the Bell System's growing digital communications network is being developed by Bell Labs engineers.

The new link is a short range, high-frequency radio system designed to serve as a major communications artery in metropolitan areas, and eventually connect with Bell's super-capacity millimetre waveguide system now under development. Dubbed Dr-18, for Digital Radio at 18GHz, the system will carry up to 28,224 simultaneous telephone conversations.

The new system differs in appearance from other radio communications facilities. It will be housed in modernistic enclosures (canisters) perched atop slim steel masts, or on roof tops. These canisters will house the system's all-solid-state receivers and transmitters, antennas, and associated equipment.

Each relay station will have up to sixteen receiver-transmitter pairs, seven in each direction for the working radio channels, and one in each direction serving as a back-up unit should one of the working channels fail. The system is currently undergoing prototype testing over a 2.7 mile transmission route at North Andover, Massachusetts.

Advanced cameras for Mars Viking Landers

The first tests of the camera that will photograph Mars from ground level when NASA's Viking spacecraft land on the planet in 1976 have been termed "successful beyond expectations."

Dr Thomas A. Mutch, leader of the Viking Lander Imaging Science Team, says that the camera's "performance and versatility is unmatched by any that NASA has yet flown on an unmanned mission."

The Viking Project, managed at NASA's Langley Research Center, will soft land two spacecraft on Mars after an 11-month journey from Earth. Each Viking spacecraft consists of an Orbiter and a Lander. The first Lander is scheduled for touch down on Mars in July, 1976.

The Lander's imaging system consists of two cameras, rising like twin periscopes from the top of the three-legged Lander. The cameras will provide colour, black-and-white, infrared and stereoscopic views of the Martian surface.

Weighing only 7kg apiece, the cameras will scan from the nearest Lander footpad to an angle of 40 degrees above the horizon. They will also rotate 340 degrees for panoramic coverage.

The instruments are facsimile cameras, especially designed to operate in unusual conditions, and are fundamentally different from the film and television cameras flown on most other NASA space missions.

Chief distinction of Viking's cameras is that very small photodiodes are positioned in the focal plane, where film would be in a conventional camera. An image is reflected from a nodding mirror through lenses onto the diodes. The mirror rotation essentially scans the image past the diodes; each time the mirror moves through one cycle, a single vertical line is scanned in the field of view.

The entire camera is then slightly rotated and the next vertical line is scanned. Because the image information is sequentially acquired, at about five lines a second, several minutes are needed to get a complete photograph.

Colour photos are created by combining data from three diodes (blue- green- and red-sensitive) and the colours are carefully calibrated and balanced by ground equipment.

Each camera will be an important instrument for the Viking science teams. One of its most important jobs will be characterising the area near the Lander, so that scientists on Earth can select spots from which samples can be obtained using a telescoping soil scoop for chemical and biological analysis in the miniature laboratory aboard each Lander.

The imaging system will also provide photometric information from near-field materials that will help deduce composition and particle sizes. In addition, it will monitor the Martian atmosphere's opacity, and record the position of the Sun and brighter planets, permitting precise location of the Lander on Mars.

The Lander cameras, whose design and construction took nearly five years, were built by Itek Optical Systems, Lexington, Massachusetts. Itek is a subcontractor to Martin Marietta Aerospace, Denver, prime contractor to NASA's Langley Center for development of the Viking Landers.

Living longer with artificial hearts, kidneys

Two of the most significant causes of death in today's society are heart disease and kidney disease. However, recent research would tend to indicate that by the end of the next decade man will be capable of overcoming both of these diseases. This article discusses the progress being made in the development of artificial hearts and kidneys in the United States.

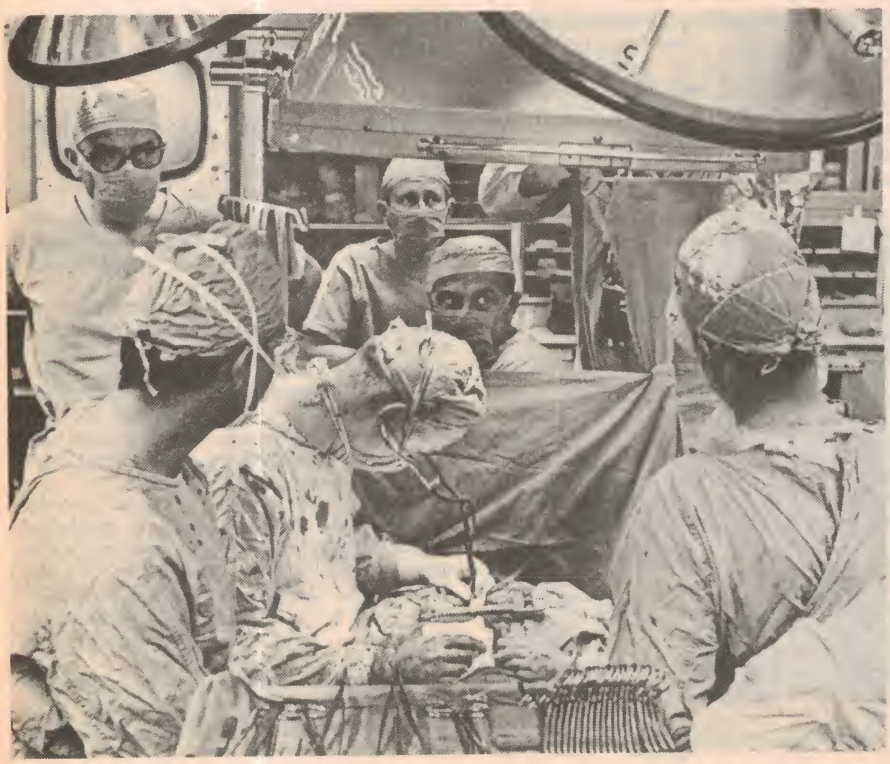
Your great grandchildren may live forever — as plastic people. Or so says science fiction writer Arthur C. Clarke who has envisioned immortal life by the simple process of replacing organic systems in the body by synthetic ones as they wear out. The inner person — whoever he might be — would live on about as usual.

No one around today is likely to live long enough to see this. But by 1985, says Richard Knock, author of a report on biomedical technology published by Stanford Research Institute's (SRI) Long Range Planning Service, we might see such technological achievements as:

- An executive dictating a letter at his desk while an artificial kidney in an attache case nearby cleans impurities out of his blood.
- A person restored to a useful life by the implantation of an artificial heart.

Both the artificial kidney and the artificial heart have great potential for saving lives. The kidney, however, is considerably farther along in its development. Kidney systems have been in use since the mid-fifties, and in the past five years have shrunk from washtub size to collegiate dictionary size. Research now is concentrating on further reduction in size and improvement in performance. The ancillary pumps, water purifiers and containers, for example, still occupy the better part of a room, and the treatment is costly, inconvenient and inefficient.

Patients have the option of travelling two or three times a week to the nearest hospital or clinic for treatment or purchasing the necessary equipment and installing it in their own home. Home treatment costs between $4,000 and $8,000 per year, while treatment in a clinic costs around $20,000 per year.



Surgeon Norman E. Shumway, M.D. (centre with stethoscope) performing open heart surgery at Stanford University Hospital.

Regardless of where he is treated, the patient must spend about 18 hours a week hooked up to the kidney machine while his blood is pumped out of a permanently implanted plastic tube in one of his arm or leg arteries, through a series of coils or fibres in the kidney machine and back into a tube in one of his veins. During the process, biological waste products such as urea gradually permeate through a plastic membrane into a cleansing fluid or dialysate.

Although the artificial kidney can keep a person alive for several years, it is not as efficient as a real one. Dialysis patients typically suffer from a variety of health problems, such as loss of appetite, poor blood coagulation, loss of calcium from the bones, anemia, and pathological degeneration of parts of the nervous system. The cause or causes of these conditions is not known.

Dr John H. Peters, manager of SRI's Biochemistry and Chemical Pharmacology Program, points out that the health problems of patients who are maintained by hemodialysis are not due to inadequate removal of common metabolic wastes such as urea from the patient's blood, as one might suspect. Numerous studies have attempted to link such materials with particular malfunctions, he says, but to date there is no evidence that implicates them.

Peters and his team are looking into the possibility that materials of larger molecular weight are responsible for these problems. In the course of their work, they are evaluating dialysis equipment that filters such materials out of the blood. He notes that such materials include not only suspected culprits but also needed nutrients, which of course will be filtered out in the same process. But it appears, he says, that any possible nutritional deficiency can be forestalled by increasing the patients' intake of high-quality protein and other supplements.

The dialysis patient endures not only relatively poor health but also a highly restricted diet, as well as the curtailment of his social life and often of his sleep because of the length of treatments required each week. In the case of home dialysis, the patient, or some member of his family, must clean the equipment between treatments and mix new dialysate. Lack of cleanliness can lead to hepatitis. Until 1973, when the treatments became reimbursable in part under Medicare, such a patient also suffered an enormous financial drain. As a result of all these factors, dialysis is a severe test for a marriage. Yet many dialysis patients and their families survive surprisingly well. One even went through medical school recently.

All this is a far cry, of course, from the kidney in an attache case. However, a new

IMPORTANT ADVANCES IN HEART PACEMAKERS

One important offshoot of the electronics industries — the manufacture of heart pacemakers — is currently picking its way through a multitude of state-of-the-art advances, and could be facing a prolonged upsurge in growth. In fact, some companies in the US are predicting growth rates of 26pc per year for the next five or six years.

Technical improvements, actual or feasible, that have entered the pacemaker field in recent years have had, or are expected to have a number of effects. These include:

- Greater use of hybrid circuitry in place of discrete components.
- Use of CMOS circuitry to improve battery life and electrode performance.
- Longer life power sources, including lithium, nickel-cadmium and sodium-bromide batteries. (Governmental regulations and medical restrictions have resulted in a declining interest in nuclear power).
- Improved geometric design and surface coating of electrodes to decrease current drain.
- Improved hermetic seals and coatings to afford greater protection to the circuitry against damage from body fluids.
- More units that are rechargeable, and more that are "bifocal," ie capable of stimulating two heart chambers.

Perhaps the main area of concerted research in recent years has been aimed at improving longevity. In addition to adopting the abovementioned improvements, this has been achieved lowering the threshold of electrical stimulation to the heart, thus reducing current requirements.

Above, a new rechargeable heart pacemaker developed at the Johns Hopkins Applied Physics Laboratory.

unit manufactured by CCI Corporation's Marquardt Division comes close. It reduces the amount of dialysate needed per treatment from 80 gallons to about 1. About the size of a table model TV set, the kidney can be moved easily and used in any place where it can be hooked up to water and electricity.

According to Richard Knock, portable dialysis systems, including an artificial kidney, may be commercially available within the next ten years.

Knock expects the annual market for artificial kidneys and equipment to grow from $8 million in 1972 to $240 million by the late 1980s, largely because of the recent decision to include dialysis treatments under Medicare. Each year about 10,000 new patients need dialysis to survive, whereas only some 8,500 receive it now. As a result of this growing market, private companies may find it profitable to finance some of their own research, thus offsetting projected cuts in federal funds. (The 1974 funds for the Artificial Kidney-Chronic Uremia Program, for example, have been cut by one-third.)

In addition to the 8,500 persons who are currently receiving dialysis treatments in the US, another 6,000 have received transplants to date. About 1,000 transplants are performed each year.

There is no question that a successful transplant is far preferable to dialysis, since it allows the recipient to lead a normal life. However, the operation is still unperfected because of the body's tendency to reject transplanted organs. Although the danger of rejection is reduced when the donor is a blood relative of the recipient, willing donors are difficult to find. And the success rate with cadaver organs, where the tissue match is likely to be poorer, is considerably lower.

Thus it is unlikely that more than a small percentage of patients suffering from kidney failure will ever recieve transplants. And even those who do will still require dialysis to cleanse their blood and improve their health in preparation for the operation. Thus, progress in transplantation will not diminish the need for artificial kidneys.

A little further over the horizon is the artificial heart, the potential market for which is even larger than that for the artificial kidney. Knock estimates that the market for hearts could approach $1.7 billion annually by the early 1990s if a suitable device is available and enough experienced surgical heart-implant teams exist to perform all the required operations. Each year, about 160,000 persons of the 600,000 suffering from chronic heart disease become prime candidates for a new heart — whether artificial or a transplant. Except for their bad hearts, these people are in relatively good health and could hope to live normal lives with a replacement heart. As in the case of the kidney today, a transplanted heart will probably always be preferable to an artificial one. However, the great majority of candidates will probably have to settle for an artificial device because of the shortage of living organs.

The main thrust of research on the artificial heart is funded by the National Heart and Lung Institute of the National Institutes of Health (NIH). The program is in its seventh year and expenditures total roughly $20 million to date. The goal is a totally implantable heart that will run trouble-free for at least 2½ years. The timetable calls for the first use in a human being by 1980.

Under NIH's Artificial Heart Program, researchers from a number of companies

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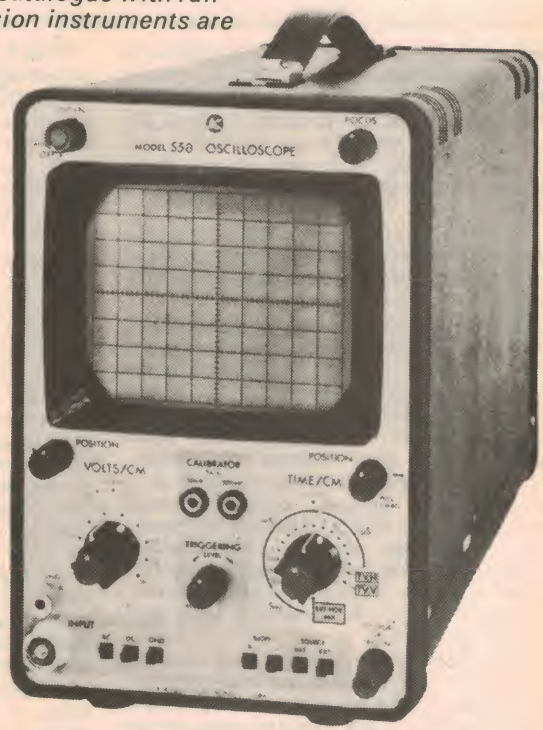

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and research organisations are developing and evaluating artificial hearts that are powered both electrically and atomically. The electrical devices have the advantage of using existing technology, which is far less expensive than the nuclear-powered devices. As a result, they are further along in development, having been implanted in calves that lived up to four days.

The big advantage of the nuclear-powered device is that it is potentially small enough so that the entire mechanism, including the power supply, could be implanted within the patient. With an electrically powered heart, on the other hand, the user would have to be plugged into an electrical power outlet for several hours every day in order to recharge a set of external batteries. It would be impractical to implant more than a small emergency battery.

An electrical system that has been tested extensively in animals consists of a heart assembly, heart control computer and transformer system. The heart assembly, consisting of two pumping chambers driven by a tiny electric motor housed between them, fits into the space formerly occupied by the animal's own heart. A battery pack, containing the control computer and small batteries, is implanted in the abdomen along with one coil of the transformer.

No wires pierce the skin. Electrical energy from an external power source is coupled from one coil of the transformer to the other through the skin.

The heart assembly shown in the photo is about 70 per cent larger than the human heart. It is designed to be driven by either an electrical motor or a nuclear one. In a nuclear system, however, a quart-sized power supply would also have to be implanted, probably in the abdomen. To make room for an object of this size, part of a person's stomach would have to be removed, whereas the pint-sized battery pack in the electrical system could be accommodated without such drastic surgery.

According to Peter Newgard, who heads the SRI team that developed the computer, transformer system and blood pump motor, the pumping speed of the device is based on the amount of blood coming into it. The more blood that comes in, the faster the heart beats.

A living heart responds in the same way to the increased blood flow that naturally results from exercise. When a person or animal exercises, the rapidly moving muscles require more oxygen. In response to this need, vascular valves throughout the body open up, causing the blood flow to the heart to increase. This in turn causes the heart to beat faster, sending more oxygen-carrying blood to the muscles.

The living heart has the additional capability of responding to chemical and neural signals which the artificial device ignores. If a person sees something that startles him, for example, his brain signals his heart to beat faster. Thus his heart "revs up" in anticipation of the increased blood flow that will result if he starts to run or fight.

By contrast, a person with an artificial heart would actually have to start exercising before his heart would beat faster. This might make problems for him, Newgard says, and is one of the things that will have to be thoroughly tested in animals. However, in modern society, the startle mechanism is probably not essential. In fact, by preparing a person for fight or flight when neither is appropriate, it may actually build up stress. Persons who use pacemakers, the electronic devices that pace the heart beat, get along fairly well without the ability to accelerate their heart rate. When they exercise, they merely get tired faster than normal persons do.

A major problem lying in the way of developing an artificial heart that can last inside the body for a long period is the tendency of the blood to clot when it comes into contact with foreign material. Unless the substances out of which the device is made are completely inert in the blood stream, blood cells will cluster around it, forming clots that make it impossible for the device to function properly.

Suitable materials have been found for relatively simple devices such as a single valve or heart assist device. In the artificial heart, however, the requirement for high flexibility combined with durability is a tough one to meet. Bruce Fritzinger, who heads a group at SRI that is developing materials for heart assist devices, points out that polyurethane seems to be the best single material for this purpose. It offers a high degree of flexibility combined with fairly good blood compatibility. To improve compatibility, he says, he and his colleagues have tried coatings of sulfonated polystyrenes, which have considerably higher blood compatibility. Another approach is to use a coating of dacron, which acts as an anchoring device on which the body will grow a new lining very similar to the normal vessel lining. Thus the blood will no longer have any actual contact with the coating itself.

Patient Dee Eads talks with a visitor during treatment with an artificial kidney machine at Stanford University Hospital. The attractive 38-year old housewife from Danville, California, is one of 2,000 Californians who are kept alive this way.

The first totally implantable artificial heart system, developed by the National Heart and Lung Institute (US), includes a heart control computer, an energy conversion system, and a blood pump motor developed by SRI. The computer is housed in an implantable battery pack (centre). The electrically powered version shown here has been tested extensively in animals, and a smaller version may be ready for implantation in human patients by 1980. An implantable nuclear-powered engine can also be used to power the heart.

Reprinted from "Investments in Tomorrow," by arrangement with Stanford Research Institute.

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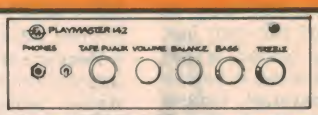

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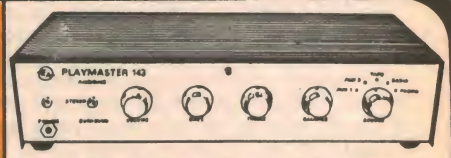

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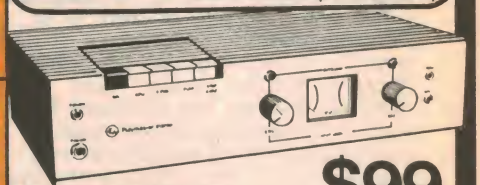

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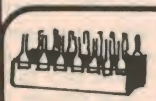

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Television — as Japan sees it

When at home, the Japanese spend most of their leisure time in the "cha-no-ma," a general-purpose room that serves as a living room, dining room, and even as a bedroom if the house is small. Almost everything of functional importance goes in the cha-no-ma, including the television set. This article takes a brief look at television the way Japan sees it.

Although growing affluence continues to broaden the range of interests of the Japanese, life at home is still basically oriented around the picture tube. Japanese visiting abroad are surprised to learn that many Americans and Europeans don't have television sets in their living rooms, and that they watch only selected programs.

Selective viewing is not for most Japanese, to whom a television knob is much like a light switch — something to be switched on and taken for granted. According to sociologists, the Japanese addiction to television stems from the relative absence of the kind of social life that exists in Western societies, and this particularly applies to the adult generation.

Television was introduced to Japan in 1953 when the Government-backed NHK (Japan Broadcasting Corporation) began beaming programs to some 866 set owners in the Tokyo area. Today there are some 87 private commercial television stations in addition to NHK, and about 24 million sets, 16 million of which are colour.

But if television has infiltrated so thoroughly into Japanese life it is because program quality is good. Viewers in the Tokyo area, for example, are offered an extravagant choice of programs on seven VHF channels which are all on air without break from 6am until midnight or later (prior to the current energy crisis).

Channels 1 and 3 are occupied by NHK, 1 for its general program and 3 for what is probably the most comprehensive educational television program in the world. The five commercial channels in the Tokyo area broadcast on Channels 4, 6, 8, 10 and 12.

NHK's scale is enormous. Its budget — 111,484 million yen in 1972 ($A249 million) — is the largest of any TV organisation, public or private. The Corporation is unique in that it is sustained by the monthly fees it collects from viewers — 465 yen ($A1.04) for colour, and 315 yen (A0.70) for black and white. It has a staff of 16,920 and, with a few exceptions, produces all its own programs in some 20 studios at an average rate of 678 a week.

NHK regularly carries live telecasts of major plenary and committee proceedings at the National Diet, sometimes for hours. It has been known to cancel a scheduled program rather than cut off a critical debate, a freedom that on occasions allows NHK to bring headline drama as it is happening into the Japanese cha-no-ma.

For example, on the first report of a would-be skyjacker's attempt to take over a Japan Airlines jet at Tokyo Airport, NHK rushed equipment to the scene and for hours provided viewers with a grandstand account that finally ended with the skyjacker's capture. On another occasion, NHK blocked out hours of normal programming for days in order to allow its cameras to zoom in on a gun battle between hundreds of police and a handful of radical students holed-up in a mountain hideout.

In addition to the regular hourly news programs, NHK's program includes a one-hour session every Sunday morning, at which representatives of the Government and the major political parties go before the nation to debate current issues. Then there are the numerous special reports, commentaries, and, when occasion demands, that favourite Japanese device known as "zadanki," or round-table discussion at which experts are brought together, often at a moments notice, to analyse and comment on a breaking news story.

All this, then, is part of NHK's broad schedule of news which takes up a total of 32 per cent of Channel 1 broadcasting time. The remainder of the time is split between cultural and educational programs (45pc) and entertainment programs (22pc).

At first sight, this kind of program balance might make NHK appear stodgy. But while it may lack flamboyance, it is hardly dull. Rather, it is public television at its best. And Channel 1 is broadcast 100 percent in colour.

NHK's service to the public is nowhere better illustrated than in the 18 hours of continuous educational programs it offers daily on Channel 3. There is a wide selection of high school and college correspondence courses, social education programs, vocational and technical programs, agricultural programs, and even a unique program for the deaf that was begun in 1961.

The commercial stations are, of course, more entertainment oriented. However, this is not to imply that they are inferior — if NHK has its big hits, so do they.

For instance, if NHK can command a 46.7 percent audience rating with "Family of the North," a serial drama presented each weekday morning, TVS can claim a 39.1 per cent rating with its own drama "Arigato," Fuji TV 27.2 percent with its serial about the adventures of the famous comic strip character "Sazae-san," NTV 15-20 percent with its professional baseball telecasts, NET over 20 percent for its live entertainment program "TV Yose" (a Japanese style variety show), and Tokyo Channel 12 lesser, but nonetheless respectable, ratings for a schedule that includes a good daily program of foreign movies dubbed in Japanese.

The five commercial stations in Tokyo differ somewhat in their program mix. One station, for example, divides its weekly program content into 16 percent news, 31.6 percent education and culture, 45.1 percent entertainment and music, 4.8 percent sports, and 2.5 percent miscellaneous, and this may be taken as a general guide to the overall pattern.

According to a recent survey, the Japanese spend an average of 3.05 hours a day watching television on weekdays, an average of 3.07 hours on Saturdays, and 3.46 hours on Sundays — a total of nearly 22 hours per week! Whether or not these figures will alter as the range of interests outside the home begin to broaden is uncertain at this stage. On thing is certain however; the Japanese spend more time watching television than any other people in the world.

Reprinted from "Jetro Information Bulletin," by arrangement.

At Sony's display square in Tokyo's plush shopping area of sukiyabashi, hundreds of office workers watch Japan's Prime Minister, Kakuei Tanaka, shake hands with China's Premier, Chou En-lai, during a recent satellite hookup from Peking Airport.

Sound-in-syncs: new way to transport TV sound

Until recently, sound and vision signals from television studios were carried separately to transmitting stations. However, a recent development by the BBC has enabled sound signals to be digitally encoded and transmitted along the same link as the vision signal during the line synchronising periods. This article describes the "sound-in-syncs" technique and discusses its advantages.

by I. G. MORGAN*

Every broadcast engineer knows that television regularly wastes time — electronically speaking, that is. In fact, some 25pc of the time required to send a complete picture is allocated to blanking and synchronising intervals — a legacy from the time when technology was less advanced than it is today.

With their innate professional dislike of waste, engineers have already made the television waveform a carrier for signals other than the picture seen by the viewer. Test waveforms are internationally used, but techniques which are perhaps less widely applied are systems such as the BBC's ICICLE, which can carry source identification and signalling information for internal use by the broadcasters, and CEEFAX, which can provide a digitally transmitted information service direct to the viewer. Both these systems convey their information during the field-blanking period. However the line synchronising periods are now also being used, for the system called "sound-in-syncs."

Sound-in-syncs is a digital system that allows the program sound to be carried along with the vision on a single video link between the studio and the transmitter. The sound is digitally coded and the coded pulse groups are fitted into the television line synchronising pulses (line sync-pulses) so that the vision signal is not impaired.

The sound and vision signals are separated in the receiving terminal, which is usually at a transmitting station, and the two signals are transmitted conventionally with separate carrier frequencies.

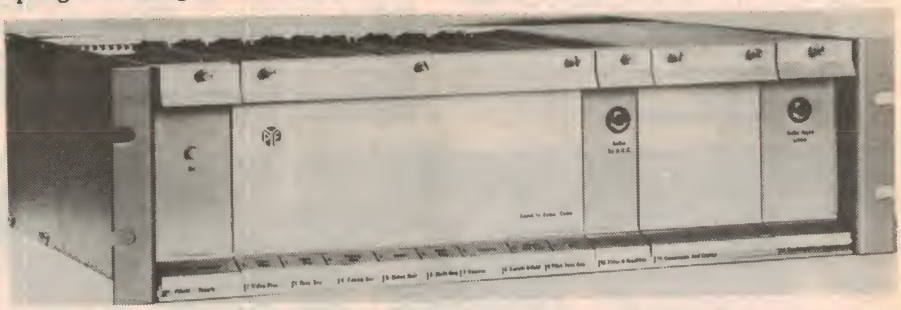
The only way by which the television viewer is likely to be made aware of the existence of sound-in-syncs is the improvement in sound-quality the system often provides over the usual analog distribution methods. For the broadcaster, on the other hand, a variety of advantages spring from using sound-in-syncs:

- Maximum use is made of resources in that the separate sound circuits, previously needed, can be allocated to other uses. Some broadcasters may turn this into a simple reduction of their bill for program distribution circuits, while the companies responsible for distribution networks find it can mean freedom from the difficulty of maintaining wideband analog sound circuits over long distances.
- Only one link has to be arranged — the vision link. This can simplify circuit booking considerably.
- Digital sound transmission has considerable advantages over analog methods since there is no progressive degradation of the sound quality along the transmission path. Sound signals leave the receiving terminal with virtually the same quality they had on arrival at the sending terminal. But digital sound distribution does require that wide bandwidth be available along the bearer circuit, as is indeed the case with television links.

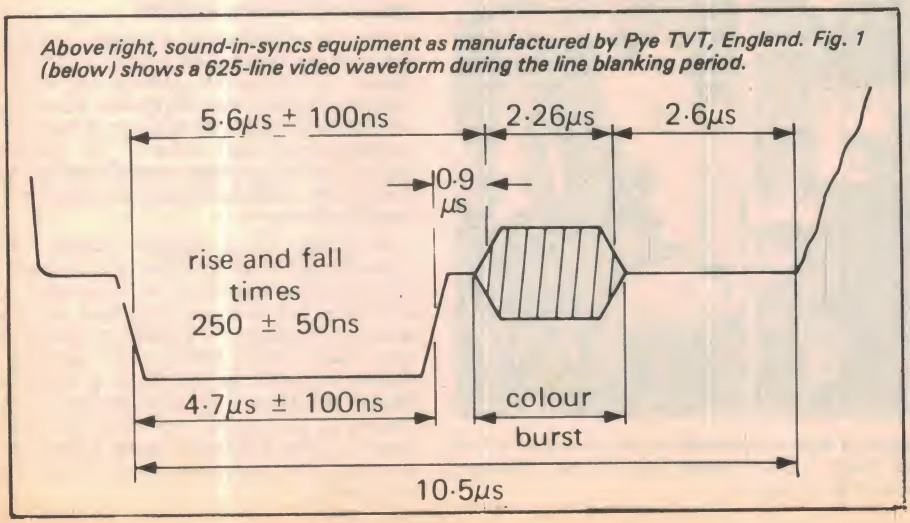
The only disadvantage that can easily be laid against sound-in-syncs is that picture monitoring along links using the system require the aid of a compact sync-pulse regenerator.

The British Broadcasting Corporation (BBC) devised sound-in-syncs at its Research and Designs department and has, since 1972, used it to convey television program sound to UHF 625-line stations throughout the United Kingdom. Commercial development of the equipment is being handled by Pye TVT. The European Broadcasting Union now uses sound-in-syncs for all its major contribution links, and the equipment is providing excellent service between places as far apart as Rabat and Helsinki, more than 2200 miles (3500 km) apart, and London and Athens, more than 2000 miles (3200 km) apart.

Fig. 1 shows the line blanking interval of a 625-line waveform. The line-sync pulse period of 4.7uS is the longest unused period available during line blanking and is also the period which allows the largest excursion of voltage to occur, namely from pulse bottom to peak white. Provided any video-clamping operations are carried out during the period between colour burst and



Above right, sound-in-syncs equipment as manufactured by Pye TVT, England. Fig. 1 (below) shows a 625-line video waveform during the line blanking period.



*Engineering Information Department, British Broadcasting Corporation.

the start of active line time, the link synchronising pulse becomes an excellent carrier for data pulses.

The leading edges of sync-pulses provide the principal timing information in the television waveform. For the successful operation of a sync separator in the sound-in-syncs receiving terminal, it is important that a guard band is left between the leading edge of the line-sync pulse and the start of the sound-in-syncs pulses. Experiment and experience have shown that this should not be less than one-third microsecond, with a similar interval before the trailing edge of the synchronising pulse. This leaves a 4.0us period for transmission of the sound-in-syncs pulses.

So that the greatest number of discrete audio levels can be conveyed, the data pulse rate must be as fast as can be accommodated within the 5.5MHz bandwidth of CCIR System I. Sine-squared pulses, familiar in the role of video test pulses, provide a convenient pulse shape with insignificant minor lobes. Pulses in this form are used with a half-amplitude duration of 182nS and use the full voltage excursion tends to 5.5MHz. The pulses are spaced at 182ns and use the full voltage excursion possible between line-sync pulse bottom and peak white. This provides sufficient noise immunity to ensure that the sound quality is substantially unimpaired even when picture

Fig. 2: The complete sound-in-syncs waveform as passed along the video link.

quality has deteriorated to an almost unusable extent.

Twenty-one such pulses can be conveyed within a 4.0uS period. This enables a marker pulse and two 10-digit groups to be accommodated within each line sync-pulse.

One small change is necessary to the basic video waveform before the sound pulses are combined with the video. This is to extend the period of the equalising pulses in field blanking to 4.5uS. At the receiving terminal the equalising pulses are restored to their normal shape.

In a 625 line, 50 fields / second system, the line synchronising pulses recur at a nominal frequency of 15.625kHz. Nyquist and Shannon have shown that to convey a waveform by any form of time-division-multiplex, the highest frequency that can be conveyed without serious distortion is half the sampling frequency. Thus, if a sampling frequency of 15.625kHz were used, the system could only convey a maximum audio frequency of just over 7kHz. This is insufficient for high-quality sound, and the solution is to sample at twice the line frequency. A sample taken during one synchronising period is coded, then stored in a shift-register in time for a second sample to be taken half a line-period later. The second sample is coded and stored like the first, and the two coded samples are

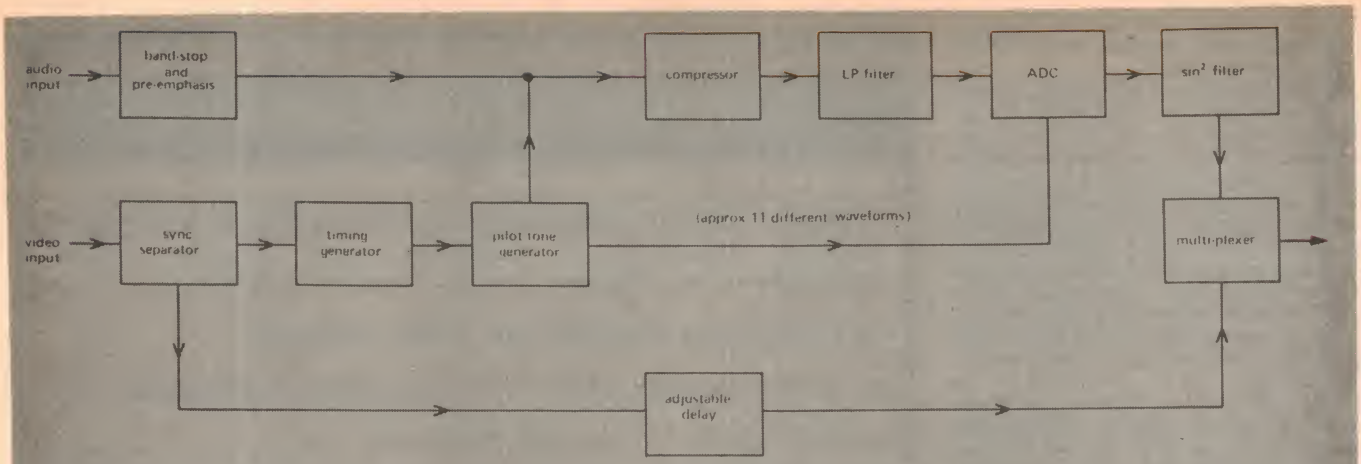
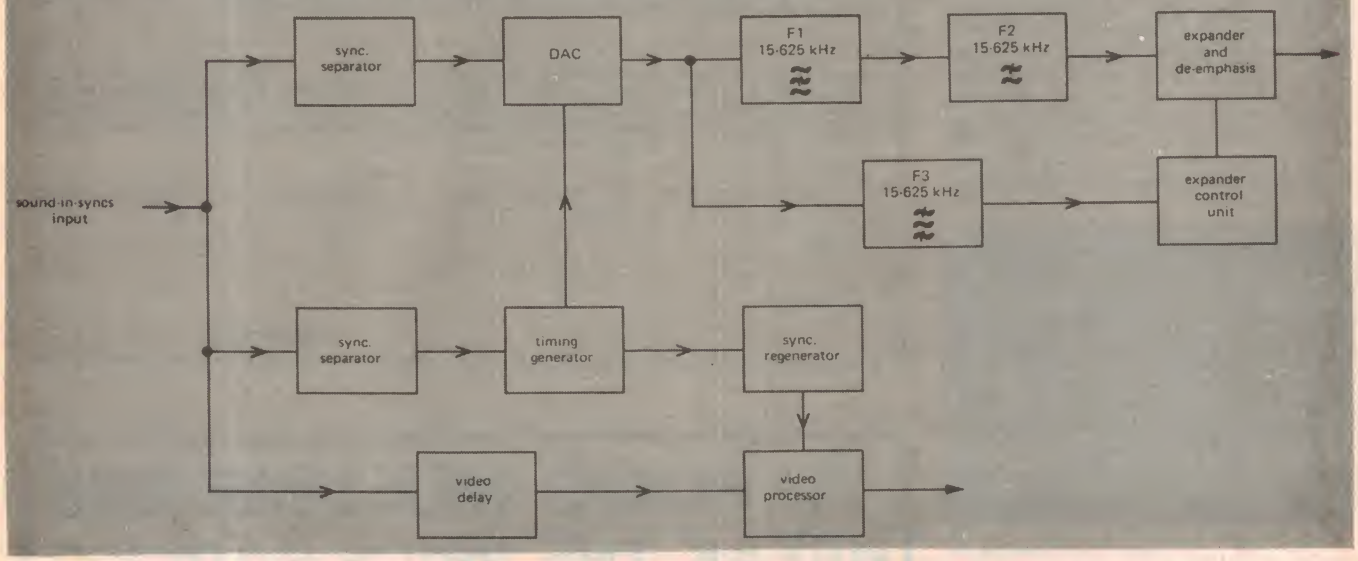


Fig. 3 (above): a block diagram of the sound-in-syncs coding equipment used for incorporating the sound signals into the line synchronising periods. Fig. 4 (below) is a block diagram of the decoding equipment used at the receiving terminal.



then multiplexed into the next synchronising period.

Sampling at twice line frequency theoretically enables an audio frequency as high as 15.625kHz to be conveyed. In practice, filter design and the need to convey a line frequency pilot tone (discussed later) results in a typical upper audio frequency limit (-3dB) of around 14kHz.

The mean voltage level of the pulse group will naturally vary according to the audio input, as the digits change to represent different levels. It will also vary if vision compression/expansion is used together with pre-emphasis, as this lifts the level of the higher audio frequencies. With these two techniques, it is theoretically possible to achieve a peak-signal-to-peak-weighted-noise-ratio of 66dB with only a ten-bit code. This performance is slightly better than can theoretically be achieved with a linearly coded 12-bit system.

The difficulty in compression/expansion is to achieve an expansion law at the receiving terminal that is the exact inverse of the compression law used at the sending terminal. The sound-in-syncs system achieves this by adding a line frequency pilot tone, at a set level, to the audio signal in the sending terminal. Together, these are processed in the compressor, coded, passed through the link system and through the decoder until, at the expander in the receiving terminal, the audio signal is amplified to return the pilot tone to the correct level, thereby automatically adjusting the level of the audio signal it accompanies.

Fig. 3 is a block diagram of the sending terminal. Filtering removes program frequencies around 15.625kHz in preparation for the addition of the low-level line-frequency pilot tone. The audio is then pre-emphasised and the pilot tone added to it at the input to the compressor.

The combined signal is applied to the ramp and counter analog-to-digital converter, where it is sampled at twice line frequency and coded into a ten-digit binary code. A pair of coded samples are stored in a shift register in a way that interleaves the digits of the two groups and complements the pulses in one of the ten-bit groups. At the right moment the coded audio is multiplexed into the video signal in a two-input gate. The complete sound-in-syncs signal, an example of which is shown at Fig. 2, is then passed along the vision link.

In the receiving terminal (see Fig. 4), the coded sound pulses are separated from the video and passed to a digital-to-analog converter to recover the audio signal with its pilot tone. Next, filtering separates the pilot-tone and the audio signal, the pilot tone being applied to an expander control unit and used to derive an expander control voltage.

This control voltage adjusts the gain of the expander amplifier such that the audio signal is returned to its full dynamic range. At the same time, the video signal is given regenerated pulses by a sync-pulse generator so that it leaves the receiving terminal with its conventional waveform.

Sound-quality is maintained even when quite serious distortion degrades the vision signal, a characteristic of the digital coding process. For example, the sound channel remains unaffected even though the peak signal to RMS noise ratio in the vision circuit has fallen to 29dB. Again, high frequency loss can reduce the level of the pulses by 8dB before any distortion of the sound appears. However, a loss of this extent would be much worse than is permissible for carrying a colour vision signal.

A mark of the system's success is that the BBC has recently been awarded its second Queen's Award to Industry for the original design of sound-in-syncs. Operational staff have also shown a marked preference for the system, with its high reliability and excellent audio quality, as compared to conventional separate distribution of the sound and vision signals. But perhaps its highest award is the fact sound-in-syncs pulses are travelling thousands of miles each day throughout the Eurovision network and, with interest in the system being shown in North America, this distance may soon be multiplied.

Could subliminal signals identify radio stations?

To the enthusiastic shortwave listener, nothing is probably more annoying than having to listen to an overseas station for an extended period of time in order to identify the station. This problem is compounded by the fact that many of these stations broadcast in foreign languages, and under these conditions, identification may be almost impossible. This article proposes the introduction of a "subliminal station identification" system as a means of overcoming this problem.

by WILLIAM A. GOLD B. Sc. (Engineering), MIE

In shortwave broadcast reception, a significant proportion of listeners are extremely interested in identifying the stations to which they are tuned. However, the multiplicity of languages in which overseas shortwave programs are broadcast from any one country often results in shortwave listeners (or DX'ers) having to spend agonising hours listening to programs of speech and music in which they are not particularly interested, in order to catch some passing reference to the identity of the station to which they are tuned.

It would therefore seem desirable to have some form of coding method that would enable shortwave listeners to quickly determine the identity of the station being received. To meet this requirement, it is suggested that a "subliminal station identification" (SSI) device could be evolved for use by shortwave broadcasting stations. Such a device would employ suitable station encoding circuitry at the transmitter with suitable decoding circuitry at the receiver, as shown in diagrammatic form in Figs. 1 & 2.

Essentially, the ideas presented in Figs. 1 & 2 involve modifying transmission equipment to allow coded pulses to be broadcast together with the normal audio modulated signal. These pulses would be of sufficiently low amplitude and short duration so as not to cause interference to the normal program. The pulses would be recovered using suitably modified receivers with complementary decoding equipment to reveal a unique identification number, say between 1 and 1,000, assigned to each of the major shortwave transmitting stations in the world.

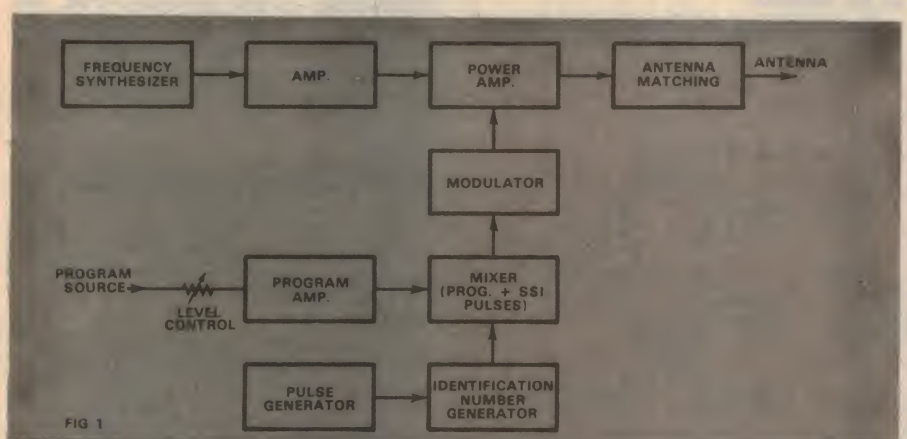


FIG 1

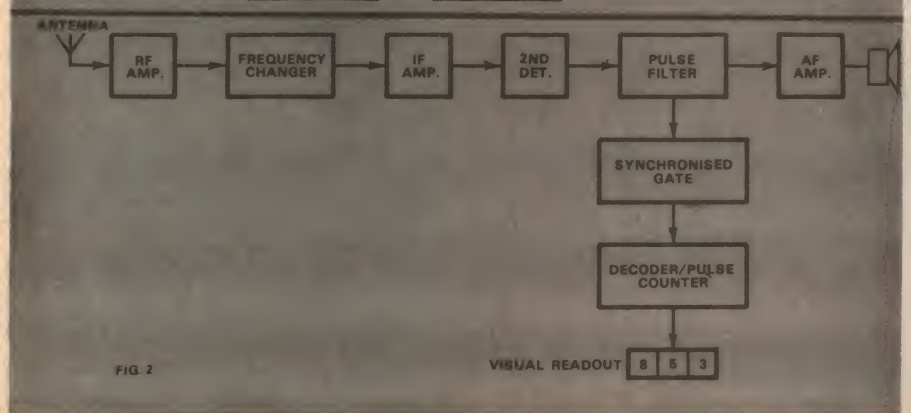


FIG 2

As well as causing no interference to program material, the encoded pulses must not cause excessive voltages and power surges in the transmitter. It is possible that these two basic requirements of a practical SSI system may be met by limiting the amplitude of the SSI pulses at the transmitter to a figure not exceeding say 10 or 15pc full modulation, and by keeping the pulse width short with respect to the period of highest frequency audio signals handled (normally 15kHz). A suggested pulse width of 2ms at a repetition frequency of one pulse per second, crystal controlled at the transmitter, should come close to meeting these requirements. However, the pulse width and amplitude values would need optimising to suit a given transmitter installation.

Given a pulse repetition rate of one per second, and assuming 1,000 major shortwave stations are given an identification number, then a suitable encoding method would be to have three series of pulse trains, each containing up to 10 pulses. The first series of ten pulses would be used to give the number of hundreds, the second series to give the number of tens, and the third series to give the number of units. A timing pulse would be included to initiate the count. The encoded station number is thus made up of a series of "intact" or transmitted pulses in conjunction with a series of "missing" pulses unique to each station.

The implications of SSI could be important if perfected, not only for shortwave transmission identification, but also for related applications on the broadcast band. Suitably modified and incorporated as an auxiliary service with a broadcast band transmission, a system of this type could provide an endless stream of information on such things as news, police messages, traffic conditions, weather, and civil defence information without interfering with the normal station program. This information would be displayed on digital display panels, and would be constantly receivable within the transmitter service area.

Given sufficient technical effort and enthusiasm, I believe there is no reason whatsoever why SSI in both its meanings (Subliminal Station Identification on shortwave and Subliminal Station Information on the broadcast band) could not be made to work and to be economically and socially worthwhile.

Build this LSI digital alarm clock

Here is your chance to build a state-of-the-art digital alarm clock, with full 24 hour indication, an integral snooze facility, a sleep facility for turning off a radio or similar device, and an automatic variable intensity display.

by DAVID EDWARDS

Since the last digital clock was presented in September of last year, another clock chip has become available in Australia. This is the National Semiconductor MM5316 Clock Chip, which is quite different in operation and offers quite a few advantages when compared to the MM5314N as used in the earlier clock.

Perhaps the most important of these is the provision of an alarm facility. Other facilities include an AM/PM indication in the 12 hour mode, a presettable 59 minute sleep timer, a 9 minute snooze cancellation for the alarm, and a display intensity control. A power failure indication is included, and illegal time displays at turn on are eliminated.

As with the previous clock, it uses the 50Hz mains both as a power source and to supply timing pulses. It uses the same four digit display, giving a 12 hour readout with AM and PM indication. However in this case switching is incorporated to change the display from hours and minutes to minutes and seconds, giving six figure accuracy without the expense of additional displays.

As only four digits are displayed at any one time, only 27 output connections are required, allowing 13 control pins if a 40 pin IC package is used. This means that there is no need to use a multiplexed display as in the previous design. This allows for a much brighter display, and eliminates possible troubles due to erroneous triggering of the counters.

The MM5316 digital alarm clock device is a monolithic MOS integrated circuit utilizing p-channel low-threshold, enhancement mode and ion-implanted depletion mode devices, packaged in a 40 lead dual-in-line package. (That mouthful is straight from the manufacturers specifications!) Operation of the clock is best explained in conjunction with Fig. 1, the block diagram of the MM5316.

The 50/60 Hz input signal is first squared up in the shaping circuit, and then enters the programmable divider. This either divides by 50 or 60 depending on the control signal applied to the 50/60 Hz select input. From the programmable divider, 1 second pulses enter the time seconds counter. From this, 1 minute pulses enter the time minutes counter, which supplies 1 hour pulses to the hours counter.

The outputs from the hours, minutes and seconds counters are coded into seven segment format in the code converters, and passed via the output drivers to the output pins.

The time minutes and hours counters are compared with the alarm minutes and hours counters in the alarm comparator, and the output passed to the alarm and sleep circuits. The output of the time seconds counter enters the sleep down counter, whose output is also passed to the alarm and sleep circuits.

The alarm and sleep circuits control the operation of the output relays. Relays are used to perform the output functions as they give a large power amplification without generating any potentially dangerous switching spikes.

The new alarm clock uses the same display chip as the previous clock, the Sperry SP-151. This is a 3½ digit neon gas discharge device using seven segments to form any desired number from 0 to 9. The characters generated are 0.5in high, and can easily be seen in normal ambient lighting.

Also included on the chip are separate AM and PM indications, which enhance the display above the previous 12 hour only diplay. Note that this display can not be used to give full 24 hour designations, as it is impossible to form the number "2" with the left hand digit. This is limited to either a blank or a "1".

As may be seen from the main circuit, the clock is powered from a small transformer which is mounted on the printed circuit board (PCB). There are two secondary windings, rated at 12V and 120V. Each winding supplies two half-wave rectifiers, giving nominal output voltages of plus 17V, minus 17V, plus 170V and minus 170V. These supplies are all referenced to a common earth, Gnd.

The plus 17V supply, Vss, is the main power supply of the clock chip. It also supplies the input wave-shaping circuits and the intensity control circuits. The minus 17V supply, -Vss, is used to power the relays and the relay driving circuits.

The high tension supplies are used to drive the display. The plus 170V rail supplies the anodes of the display, while the minus 170V rail is used for the keep alive cathode.

The MM5316 has 11 control inputs to select the various operating modes and display

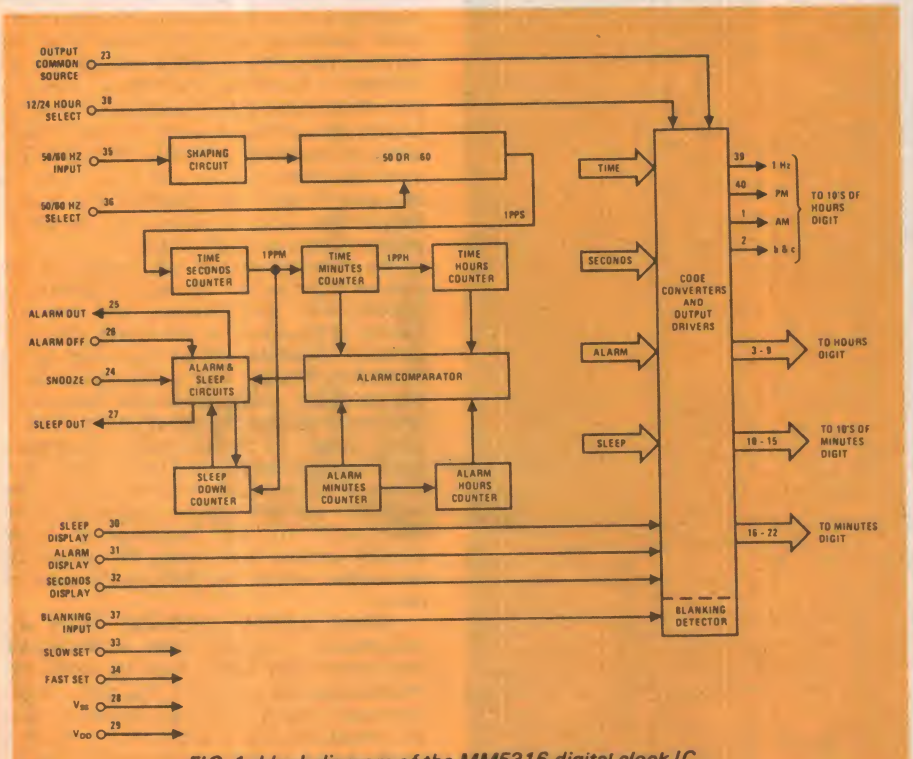


FIG. 1: block diagram of the MM5316 digital clock IC.

Above: the completed prototype housed in a simple aluminium case.

forms. Pin number 38 is the 12/24 hour select input. If this pin is left unconnected, an internal pulldown resistor takes charge, and the outputs for the most significant display digit (10's of hours) are programmed to provide a 12 hour display format. Conversely if the internal resistor is "overruled" by connecting pin 38 to Vss, a 24 hour display is provided.

In the version of the clock presented here, this pin is not connected to Vss, giving a 12 hour display. The outputs of the 10's of hours digit are connected to activate both the "1" for hours 10, 11 and 12, and also the AM and PM indications.

Pins 36 and 35 are the 50/60Hz select and the 50/60Hz input connections respectively. If pin 36 is left unconnected, the programmable divider is set to divide by 60, giving a 1pps rate at the output when a 60Hz signal is connected to pin 35. When pin 36 is connected to Vss, the programmable divider is set to divide by 50, so that a 1pps rate is still obtained at the output when a 50Hz signal is connected to pin 35. As the mains frequency in Australia is 50Hz, we have connected pin 36 to Vss.

The 50Hz signal for pin 35 is obtained from the 12V secondary of the power transformer. The signal is squared up by T25 in conjunction with R33 and C5, which form a simple RC filter. The output signal is obtained from the collector of T25, via the collector load resistor R34. Capacitor C6 feeds the positive going pulses from the collector of T25 into pin 35 of the IC, and also to the base of T24.

The collector load of T24 is formed by C7 and a combination of fixed and variable resistors, R35, VR1, VR2 and LDR. This forms a phase sensitive network, so that the mark/space ratio of the collector waveform varies with the effective collector resistance. This signal is fed into the blanking input, pin 37, and varies the intensity of the display. When pin 37 is connected to Gnd, the display is inhibited, while a connection to Vss enables the display.

Thus by varying the mark/space ratio of a signal swinging between Vss and Gnd, we can easily vary the intensity of the display. The advantage of this method is that we are using a resistance change to control the display, and using only relatively small currents. This allows an LDR to be used to give automatic control of the display intensity, according to ambient light level.

There are actually four different ways in which the display brightness may be set, if desired. To achieve fixed absolute maximum brightness, a wire link is fitted in place of VR1. In this case neither VR1, VR2 or the LDR are required. If you do not need absolute maximum brightness, use a 100k resistor instead of the wire link.

If variable brightness is required, fit a 100k and a 1M preset potentiometer respectively, in the positions shown as VR1 and VR2. The LDR is not required in this case. These two controls, one coarse and one fine, allow a wide range of brightness levels.

The final option is to have automatic brightness control, as shown. This is achieved by fitting a 100k potentiometer to VR1, and an LDR such as the ORP12 in the designated position. VR1 is adjusted in darkened conditions to give a display which does not glare. As the ambient light increases, the LDR automatically increases the intensity of the display, ensuring that it can be easily seen in bright sunlight.

The next three control inputs to be considered are the display mode select inputs, pins 30, 31 and 32. If all of these inputs are left unconnected, the display drivers present the time-of-day information to the appropriate display digits. When pin 32, the seconds display input, is connected to Vss, digit 1 (the left hand one) is blanked, digit 2 displays the minutes, digit 3 displays the 10's of seconds and digit 4 displays the seconds.

When pin 31 is connected to Vss, the alarm setting is displayed, with the same format as the normal time display. When pin 30 is connected to Vss, the sleep down counter setting is displayed. Digits 1 and 2 are blanked, digit 3 shows the 10's of minutes and digit 4 shows the minutes. In both the sleep display mode and the seconds display mode, the AM and PM indications are blanked.

These three pins are all equipped with internal pull-down resistors, so that they can be connected to Vss with simple single pole single throw switches. If more than one pin is connected to Vss at the same time, the display priorities are in the order of sleep (overrides all others), alarm, seconds and time (no other mode selected).

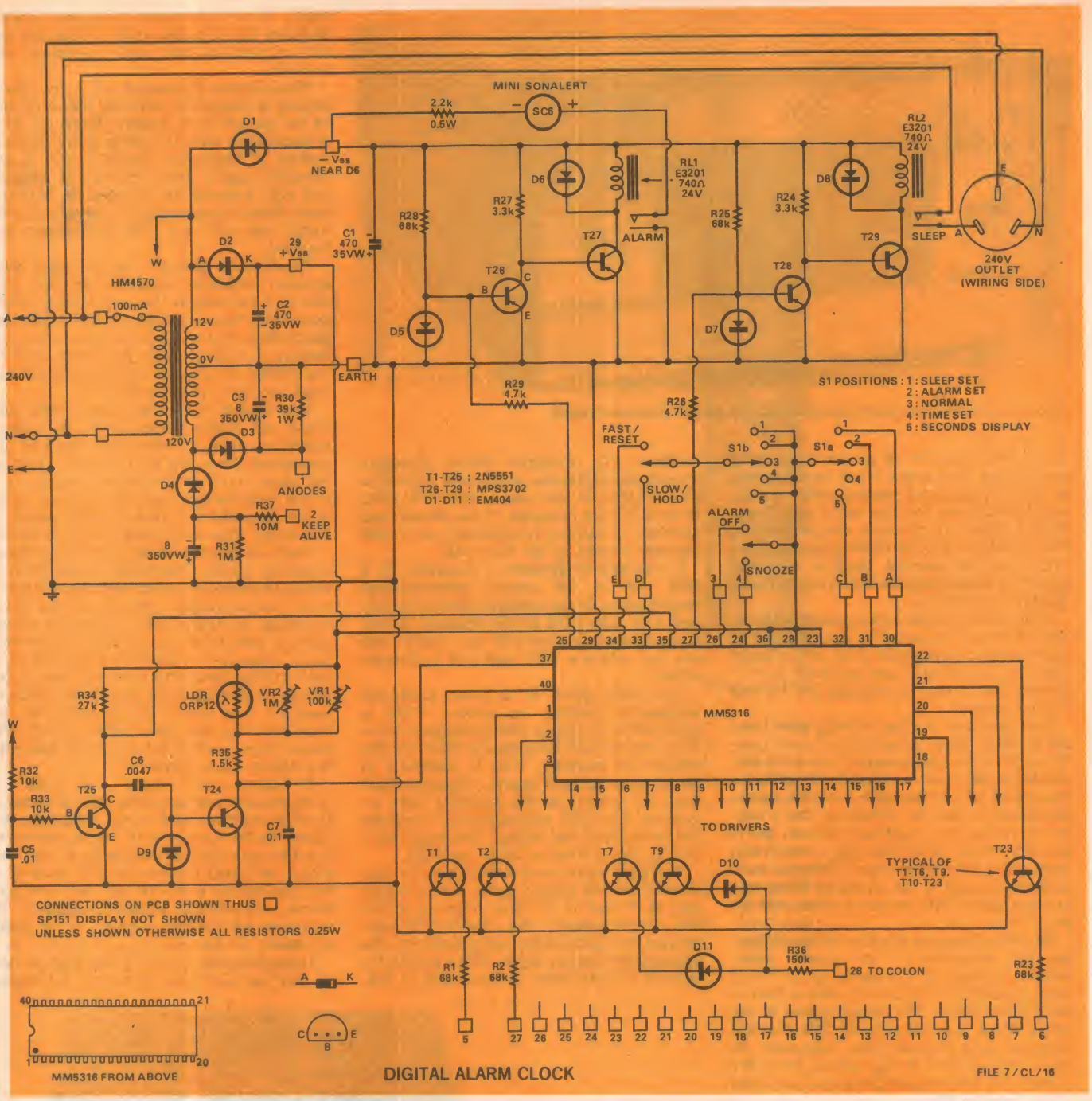
Pins 24 and 26 are the snooze input and alarm off inputs respectively. In normal operation, both of these pins are left unconnected. When the time counter reaches the same count as the alarm counter, the alarm comparator sets the alarm latch, which operates the alarm relay, sounding the alarm. This occurs once every 24 hours.

Once the alarm sounds, it will continue to sound for 1 hour, unless the alarm latch is reset. At the end of 1 hour, the alarm latch is reset automatically, ready for the next sounding, 23 hours later. When the alarm sounds, and if the snooze input is momentarily connected to Vss, the alarm latch is inhibited for about 9 minutes, turning off the alarm. At the end of this period, the alarm is sounded once more. This process can be continued for an hour, after which the alarm latch is reset till activated again by the alarm comparator.

If instead the alarm off input is momentarily connected to Vss, the alarm latch is reset straight away, inhibiting the alarm for the next 24 hours. If the alarm off input is connected permanently to Vss, the alarm is disabled permanently, so that it will not sound, even though the time and alarm counters may become coincident. To activate the alarm again, it is only necessary to disconnect pin 26 from Vss.

The remaining two controls, pins 33 and 34, are the slow and fast time set inputs

Rear view of the unit showing the five position function switch and the "sleep" mains output socket.



DIGITAL ALARM CLOCK

FILE 7/CL/16

respectively. They are activated by connection to Vss, and their functions change depending on the display mode selected.

In the time display mode, the minutes normally advance at a 1/60Hz rate. When the slow set is activated the minutes advance at a 2Hz rate. When the fast set is activated, the minutes advance at a 60Hz rate. This allows the correct time to be set rapidly and easily on the clock. If both slow and fast set inputs are activated at the same time, the minutes advance at a 60Hz rate.

In the seconds display mode, application of the slow set input inhibits the entire time counter, holding the time constant. When the fast set input is applied, the seconds and 10's of seconds digits reset to zero without a carry to the minutes digit. This means that if the display time is say 3 minutes 41 seconds, when the fast set input is applied, the display will change to 3 minutes 00 seconds for as long as the input is applied.

If both a slow and a fast set input are applied at the same time, the time counter will reset to 12:00:00 AM (12 hour format) or 00:00:00 (24 hour format).

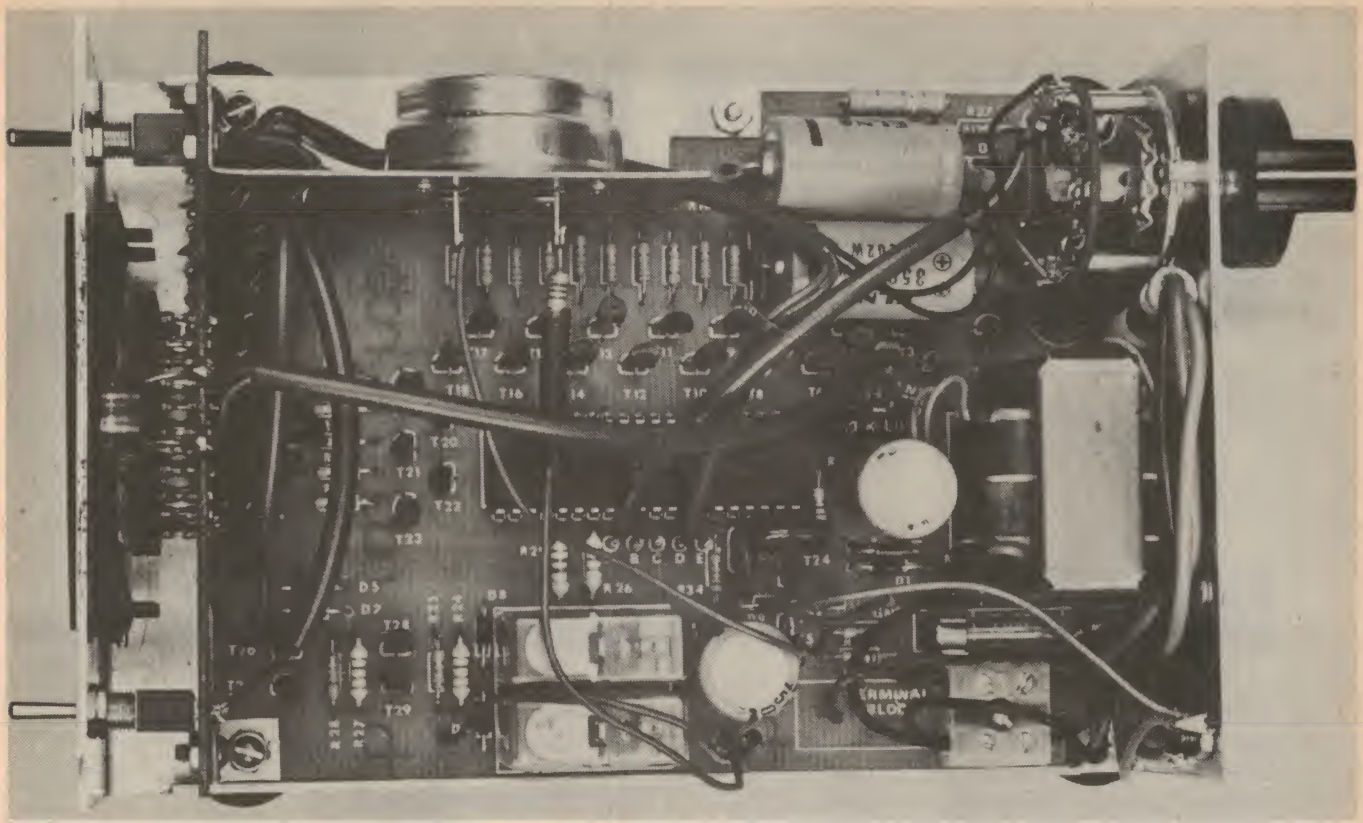
In the alarm display mode, the slow set input advances the alarm minutes at a 2Hz rate, and the fast set input advances the alarm minutes at a 60Hz rate. In the 12 hour format, application of both controls simultaneously sets the alarm counter to 12:00 AM, and in the 24 hour format, sets the alarm counter to 00:00.

In the sleep display mode, a slow set input subtracts the sleep counter at a 2Hz rate, while a fast set input subtracts the count at a 60Hz rate. If both inputs are applied, the count subtracts at a 60Hz rate. During this process, the sleep counter will recycle, going from 02-01-00-59-58 etc. During normal operation of the clock, and while the time is being set, the sleep counter will not recycle on reaching 00.

The major components used in the clock are being made available as a special kit offer by NS Electronics Ltd. They will be available from the distributors of NS Electronics components, which are shown on a list published elsewhere in this issue. The kits will not be available from NS Electronics Ltd.

The kit comprises the following parts: one MOS/LSI Alarm Clock Chip, National MM5316; one Sperry SP-151 display Module; one NS Circuit Board 00053-01; one NS Circuit Board 00054-01; connectors for the display and clock chips; a transistor kit; and an application note. The special offer price of the kit is $36.95 plus tax. The NS Electronics distributors will also be able to supply the printed circuit board mounting transformer, the display bezel and other specialized components.

Other kitset suppliers should also be able



This interior view of the completed unit clearly shows the disposition of all the major components.

to supply parts for the kit, shortly after this issue goes on sale.

The instructions supplied with the NS kit give one possible way in which to connect the control inputs of the chip. We have modified this method slightly, giving what we believe is a more usable clock, particularly with regard to the alarm controls.

As can be seen in the photographs, our clock has two miniature toggle switches on the front panel, and a five position rotary switch on the rear. The rotary switch is used to control the display mode, and the toggle switches to control the alarm and time setting functions.

The right hand toggle switch is a three position single pole type, which is spring loaded to return to the centre position. This is used to advance the display, and to set the alarm counter and the sleep time counter. In normal use, this switch is disabled, so that it is impossible to accidentally alter the time setting.

The left hand toggle switch is also a spring loaded three position single pole type, but is only spring loaded on one side. The spring loaded side is used to activate the snooze facility when the alarm sounds, while the other position is used to turn the alarm off permanently.

The rotary switch is a five position double pole type. One pole is used to control the display mode, and the other controls the fast/slow time advance toggle switch. We used the recommended relays for the alarm and sleep controls, and mounted them in the correct positions on the main PCB.

For the alarm indication, we used a "MINI SONALERT", type SC6. This is a small audible signal transducer which uses an electronic oscillator and a piezoelectric crystal to generate a 3500Hz tone. There are no moving parts in the conventional sense, as only the crystal moves. We chose this type of sound source because of its low current drain and ease of application. We used a 6V model, and used the -Vss rail to supply it, via a suitable dropping resistor.

We used a chassis mounting 240V mains socket on the rear of the case as the sleep output. Only light duty appliances such as radios or bedside lights should be used with this socket, as the rating of the relay may be exceeded.

The clock is mounted in a small aluminium case, 124 x 68 x 190mm. The majority of the components are mounted on the main PCB. This board is coded on the component side, making the task of fitting components much easier. The display chip is mounted on a separate board. The only components not mounted on the two PCB's are the alarm unit and its associated resistor, and the LDR.

Construction of the clock should be a relatively simple task, as both the PCBs are fully coded and pre-tinned. The first job to be completed is the metalwork of the case. We used the specially designed case made by Printed Circuit Graphics. Metalwork diagrams will be available showing the shape of the case and all the modifications required.

Commence by making the bracket used to support the display PCB and the Sonalert. This is made from 20 gauge aluminium. A small bracket is also required to hold the other side of the board. Two clearance holes are drilled in the bracket for the terminals of the Sonalert, the four smaller ones for the mounting lugs. The Sonalert is held onto the bracket by bending over the mounting lugs. Note that suitable holes will have to be drilled in the PCBs to suit the brackets.

The positions of all holes needed on the display board are shown in Fig. 2. Choose the hole sizes to suit the machine screw size used. Ensure that the tinned copper pattern near the clearance holes for the switch on the right hand side of the diagram does not short the switch contacts. If necessary, it can be scraped off with a sharp tool, as it is not used.

The required holes on the clock chip board should present no problems. With the exception of one of the bracket holes, they are all predrilled. The board has four corner holes which may need to be enlarged. We used the two at the front of the board to hold the brackets in place. The four corner holes are also used to hold the insulated spacers supporting the board.

The clock chip PCB, with the display PCB attached, is held in the chassis by short screws in the insulated spacers. These screws are also used to attach the rubber feet. Mount the board on 5mm insulated spacers, as far back in the chassis as possible.

The remaining hardware can now be fitted to the chassis. The chassis mounting mains socket is screwed to the rear of the case using suitable machine screws and nuts. A grommetted hole must be provided behind the socket to allow the connecting wires to pass through the rear of the chassis.

The mains cord enters through another grommetted hole, and is clamped to the rear of the case. Do not vary the position of the entry hole or the clamp, otherwise the PCB mounted transformer will not fit in its correct position. The rotary switch can then be fitted in the appropriate position.

The front panel can now be prepared. We polished the aluminium with steel wool, and then used stick-on lettering to mark the functions of the switches. A coat of clear lacquer gave a protective finish to the lettering.

The chassis lid is made from a single piece of aluminium, folded into a "U" shape. A pattern of small holes is drilled in

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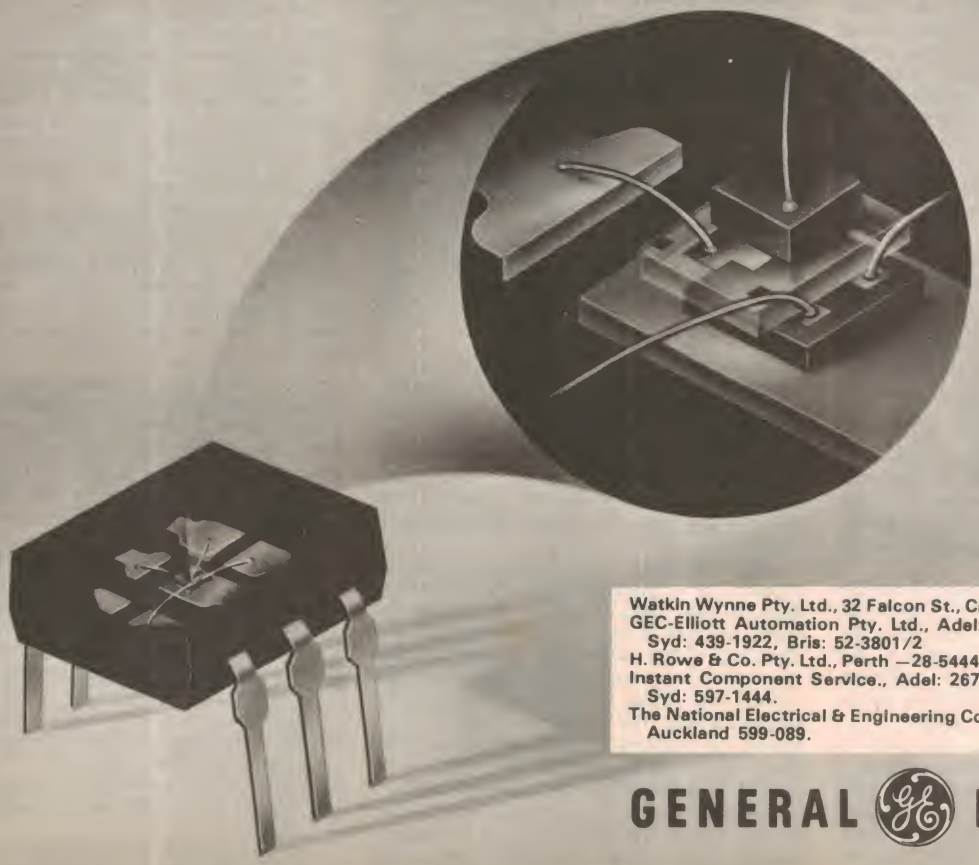

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one side, to allow the alarm to be heard. We made a small label from Scotchcal to indicate the functions of the rotary switch, and attached it on the top rear of the lid. Dyeline prints of this will be available.

Once all the mounting arrangements for the various components have been checked, the PCBs can be wired up. As the conductors and the spacing between them are both quite small, it is necessary to use extreme care in this job. Use as small a soldering iron as possible, and apply a minimum of solder.

Commence with the main PCB. The positions of all components are marked. Fit the small components such as resistors and diodes first. Note that R30, the 1 watt resistor, must be mounted clear of the circuit board, as it will dissipate quite a lot of heat, and needs to have adequate clearance to allow air circulation for cooling.

Once this has been done, the connector strips for the clock chip can be added. Snap off the top portion of each strip after soldering so that each connector is isolated from its neighbour, and push a thin pin into each connector to free them up slightly. Install circuit board pins into all the numbered and lettered holes on the board. Take extreme care not to make mistakes, as these pins are hard to remove once fitted, without damaging the circuit.

The remaining components can now be fitted. Leave the large capacitors, the relays and the transformer until last, as these tend to hide some of the smaller components. Refer to the circuit diagram for details of the transistor locations. It will be necessary to carefully bend the centre lead of each transistor towards the flat on the body before inserting it in the board.

Mount the two high voltage electrolytic capacitors, C3 and C4, as shown in the photograph, so that a space is cleared for the rotary switch. It may be necessary to extend the leads with short pieces of wire. Do not omit the insulating tubing from the leads, as the voltages on them are quite high.

The transformer is attached to the board by bending over the lugs provided. They are bent towards one another, and one is soldered to the area provided. Ensure that the transformer is oriented correctly, so that the windings correspond to the connection points on the board.

Mount the relays in the specified positions, and solder to the pads provided. No arrangements have been made for the wiring to the contacts of the relays, so that the appropriate connections must be made with insulated hook-up wire. This can be completed at a later stage.

The connector pins supplied can now be soldered to the display board. When this has been completed, "open" each connector with a small pin or other suitable tool. Do not enlarge the connectors too much, or loose connections to the display will result. Ensure that the connector pins are straight.

The LDR can now be attached to the PCB, using the two top holes made previously. Use a small piece of tinned copper wire to make a physical connection to the board, and then complete by soldering.

The next job is to complete the connections between the two PCBs. The numbered connections on each board are matched. Do not make a connection between pin 29 on the clock chip board and the display board. Great care will have to be used in this process, as the conductor spacing is not very large.

Cut 28 50mm lengths of thin insulated hookup wire, and strip about 3mm of insulation from one end, and about 10mm of insulation from the other end of each wire. The connections to the display board are made in the manner shown in Fig. 4. This gives a firm anchorage to each wire, preventing them from pulling the conductors off the board. There is no space available to allow the wires to be soldered in the normal way, with the wire passing through from the component side of the board. Extreme care must be taken to ensure that no bridges are formed, on either side of the board.

Once this has been completed and checked, the wires may be soldered to the pins on the clock chip board. To avoid mistakes, use multicoloured hook-up wire, and follow a repeating colour code, such as black-green-blue-red-black etc.

The two boards can now be bolted together, using the brackets, and the connections to the LDR completed. It is connected in parallel with VR1, the 100k potentiometer. The Sonalert can also be wired into the circuit. The positive terminal is connected to the ground terminal near the

COMPLETE PARTS LIST FOR CLOCK

1 clock kit from NS Electronics distributors, comprising:
1 MOS / LSI alarm clock chip, National MM5316.
1 Sperry SP-151 display module.
1 NS circuit board 00053-01.
1 NS circuit board 00054-01.
Connectors for display module and clock chip.
Transistor kit.
Application note.

Additional Parts Required:
11 silicon diodes, EM404 or equivalent.
2 470uF, 25VW electrolytic capacitors, PCB mounting types.
2 8uF, 350VW electrolytic capacitors (see text).
1 0.01uF 63V disc capacitor.
1 0.0047uF 63V disc capacitor.
1 0.1uF 63V capacitor.

25 68k ¼W resistors.
2 3.3k ¼W resistors.
2 4.7k ¼W resistors.
1 39k 1W resistor.
1 1M ¼W resistor.
2 10k ¼W resistor.
1 27k ¼W resistor.
1 1.5k ¼W resistor.
1 150k ¼W resistor.
1 10M ¼W resistor.
1 2.2k ½W resistor.

1 transformer, Ruler Products HM4570 or similar.
1 fuse, 100mA.
2 fuse clips McMurdo 1397-01-5 or similar.
1 miniature rotary switch, two pole 5 position.
1 miniature toggle switch, C&K 7105 or similar.
1 miniature toggle switch, C&K 7107 or similar.
1 terminal block, miniature 240V.
1 digibezel, part number 910-60.
1 case.

Additional Parts Required (optional):
2 relays, Associated Controls E3201, 740ohm 24V.
2 preset potentiometers (see text).
1 light dependent resistor ORP 12 or similar (see text).
1 Mini Sonalert SC6, 6V 3500Hz.
1 240V chassis mounting socket.

Miscellaneous
1 knob, 4 rubber feet, 4 spacers, aluminium brackets (see text), nuts, screws, washers, lock-washers, solder, hook-up wire, spaghetti tubing, mains cord and plug, 2 rubber grommets, cord clamp, solder lugs.

Note: resistor wattage ratings and capacitor voltage ratings are those used in our prototype. Components with higher ratings may generally be used provided they are physically compatible. Components with lower ratings may also be used in some cases, providing ratings are not exceeded.

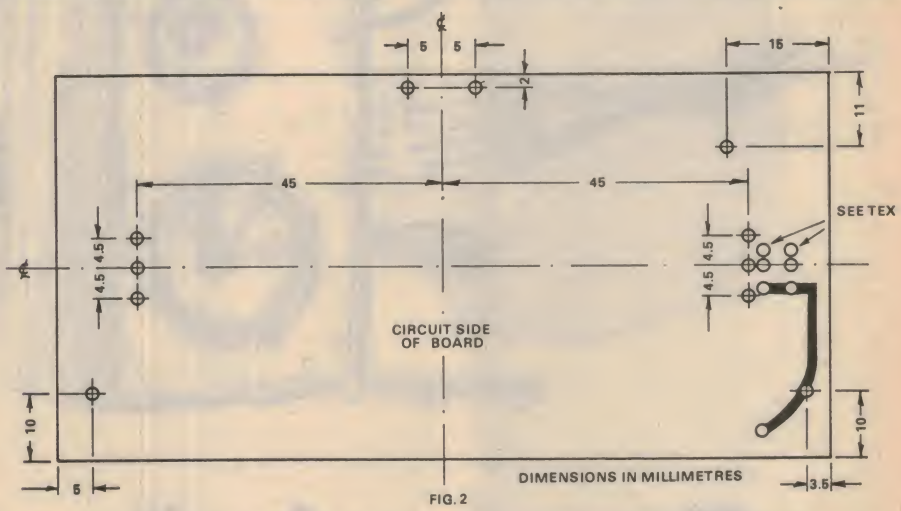

FIG. 2

FIG. 2: this diagram shows the positions of all holes needed on the display board. Choose the hole sizes to suit the machine screw size used.

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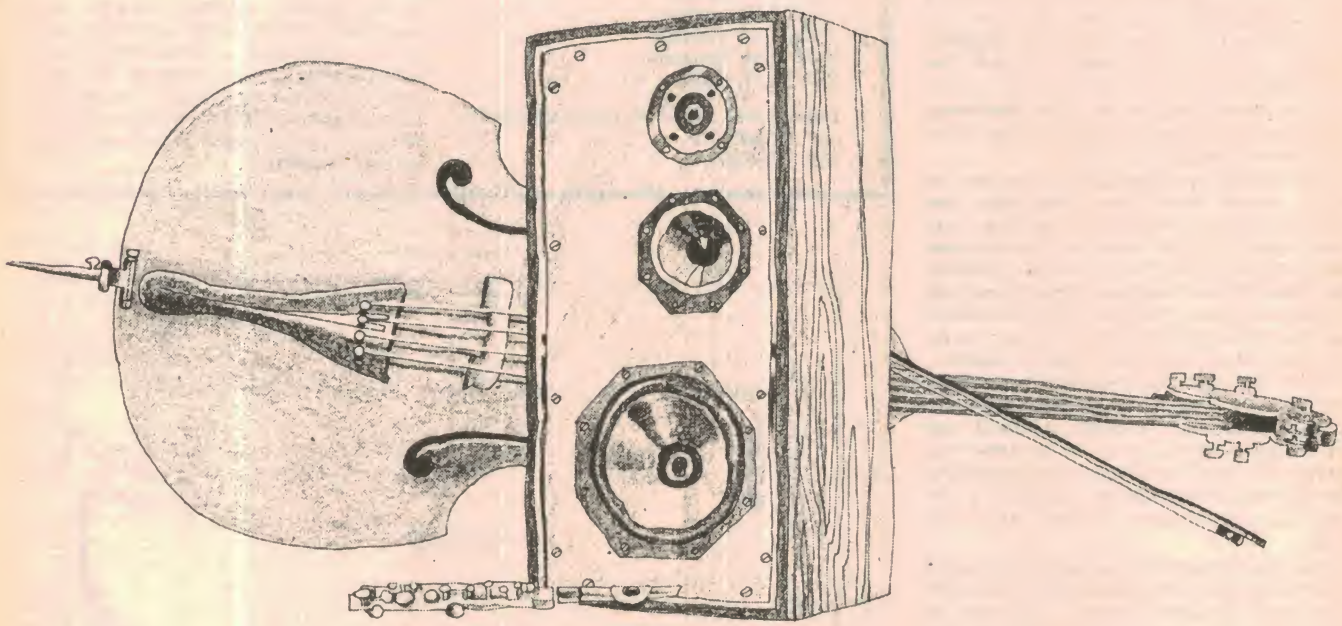

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power transformer. The negative terminal is connected via a 470 ohm ½watt resistor to one side of the normally open terminals of RL1. The other contact is connected to the -Vss rail, which is the unmarked terminal near D6.

The next stage in construction is to complete the 240V mains wiring. The earth wire is terminated at a solder lug positioned in the top right hand corner of the rear of the chassis. The active and neutral wires are terminated in the terminal strip. One wire from the active side of the strip is connected to the fuse, and the other to the normally open contacts of RL2. The other normally open contact is connected to the active of the mains socket on the rear of the case. The neutral from the transformer and the neutral from the mains socket are connected to the neutral side of the terminal strip.

Do not forget to connect the earth lead from the socket to the same earth point as the mains cord. Do not make these leads too short, as it will be necessary to move the boards in and out of the chassis with the connections made.

An earth connection also has to be made from to this point from the ground pin on the circuit board.

Mount the two toggle switches on the front panel, but do not tighten their securing nuts. Screw the nut on the inside of the case right down onto the switch body, allowing the switch to be pushed forward. Carefully insert the display into its connectors, and push it completely home. The Digibezel can now be installed. The back clamping plate is installed with the large "knobs" putting pressure on the rear of the panel. The four push-on fasteners hold the bezel in place.

The combined circuit boards can now be inserted in the chassis. Insert the rear first, and then slowly lower the front into position. It should just clear the Digibezel and the two toggle switches. These may now be pushed back through the holes in the PCB, and their nuts tightened.

The rotary switch can now be placed in position, and the remainder of the wiring completed. Details of the connections to make are shown in the circuit diagram. This should complete all the construction, apart from fitting the clock device itself. This has purposely been left till last, as it is susceptible to damage by static charges.

Carefully remove the device from its protective packaging, trying not to touch the pins with your fingers. Pin 1 is marked on the top of the package by a small dot, at the end where the semicircular indent is. Push the IC firmly into the pins, making sure that no two pins are shorted, and that all are fitted correctly.

We are now ready to check the operation of the clock. Before turning on, check that there are no short circuits or other wiring faults. Place the rotary switch in the TIME SET position, and the ALARM OFF toggle switch in the OFF position. Set the 100k preset pot in the fully clockwise position, i.e., with the wiper nearest to the IC. This will give a maximum intensity display. Now switch on.

The display should immediately light up, and either the AM or the PM indication should be flashing at a 1Hz rate. This is

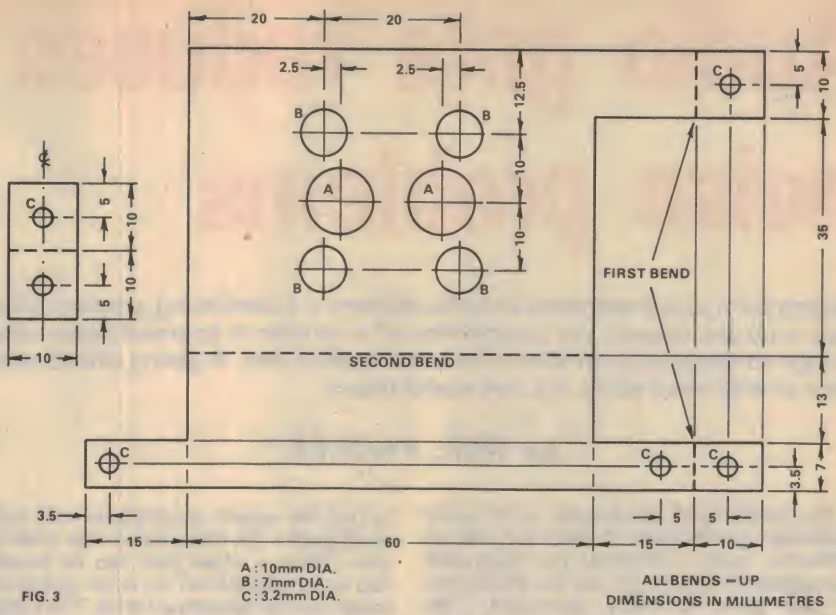


FIG. 3: two brackets are needed to mount the display board and the Sonalert. Make them of 20 gauge aluminium for ease of working.

normal. Operation of the Slow SLOW/HOLD toggle should cause the display to advance at a 1Hz rate, while at the same time the flashing indicator should stop and remain visible continuously. Operation of the FAST/RESET toggle should cause the display to advance at a 60Hz rate. Cycle the display through a complete 24 hour period, and check that all segments of the display light up.

If any segments fail to light, the cause is almost certain to be a loose connection at the rear of the display. This can be fixed by gently moving the display. Be warned, however, that high voltages exist on some of these pins, so do not poke indiscriminately with your fingers.

Once satisfied that all segments of the display are correct, switch to the SECONDS DISPLAY position. The display should change from hours and minutes to minutes and seconds. Operation of the SLOW/HOLD toggle should hold the display fixed. Operation of the FAST/RESET toggle should reset the seconds to 00 without changing the minutes. This facility can be used to set the time to the nearest second.

Now switch to the NORMAL position. The time in hours and minutes should be displayed, and the right hand toggle switch should be disabled, making it impossible to alter the display.

Now switch to the ALARM SET position. Operate the FAST/RESET and SLOW/HOLD toggle switch to advance the alarm setting through a complete 24 hour period, and then set the alarm for some convenient time, such as 7.00AM.

With the ALARM OFF/SNOOZE toggle switch set in the central position, move the switch to TIME SET and operate the time advance toggle so that the clock reads 6.59AM. Then wait and see if the alarm goes off, which should occur in 1 minute or less.

After the alarm sounds, operate the SNOOZE toggle switch. The alarm should cease, and sound again in approximately nine minutes time. When it does, operate the switch to ALARM OFF and then back to the central position. The alarm should cease, and not come on again for twenty-four hours. This can be checked by

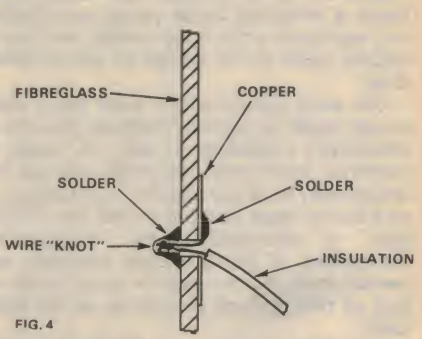


FIG. 4: connections to the display board should be made as detailed above. This gives a firm anchorage for each wire.

manually advancing the time. When the alarm sounds again, keep advancing the time, and check to see that it ceases after one hour.

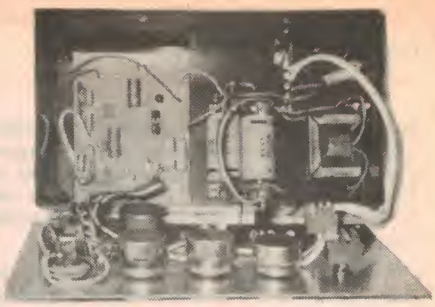
Having satisfied yourself that the alarm is working correctly, we can now test the sleep facility. Switch to the SLEEP SET position, and observe the display, which should read 00. If it does not, use the FAST/SLOW toggle switch to obtain this reading. Plug a suitable indicator, such as a bedside lamp, into the socket on the rear. Operate the SLOW toggle, and the display should change to 59. At the same time, the light should come on.

Operation of the FAST/SLOW toggle switch should make the reading on the display decrease. When it reaches 00, the light should go off. As a final check, set the sleep counter to 59, and switch to TIME SET. 59 minutes later, the light should go off.

The final adjustment is to set the display intensity. Take the clock into a dark room (the darker the better), and adjust the 100k preset pot so that the display can just be seen easily, and does not glare. Then fit the cover, and your clock is complete. Under normal ambient light conditions, place your finger over the LDR, and check that the display intensity decreases.

The final step is to place your clock in its final position, adjust to correct time, set the alarm, and relax.

Audio gate reduces noise problems



Getting rid of unwanted noise in audio systems is a continuing problem. While there is no one answer, the combination of a number of approaches can often change an impossible situation into an acceptable one. A gating circuit, either alone or with other tricks, is a very useful device.

by NEIL PACKER*

The audio field is plagued with many problems; not the least of which is noise. As domestic audio equipment has improved throughout the years, so has the awareness of the noise problem increased. The producers of tape and disc material have subsequently caught the challenge to reduce as far as possible the background noise of recorded music programs. Studios are equipped with many useful devices to reduce noise in all stages of sound recording.

One such device is the noise gate, commonly used during the mixdown process in multitrack recording. If, say, 16 tracks of material have been recorded, not all the tracks may be in use at once. For instance, 2 or 3 tracks may be used to add the "fiddly bits" of percussion and "dropped-in" harmonies. If the mixdown engineer has twelve arms, he can usually accomplish the feat of fading each section in at the right time!

You may ask, "Why can't all the channels be left open to add their little bits when the time comes?" The noise output from one channel may be quite acceptable, or even the cumulative noise from 2 or 3 channels, but the noise output off tape from 16 channels is quite unacceptable.

The noise gate neatly overcomes the problem in the following manner. As the name suggests, when noise alone is present it is gated out. This is achieved by attenuating all signals under a predetermined threshold level. Before the signal surpasses the threshold level, a constant attenuation is applied; usually set by a front-panel control. Once the signal surpasses the threshold level, the gate is switched out and the system returned to normal gain (Fig. 1).

Well then — this is all very nice, but what is the relevance of noise gates to those of us not privileged to be born into a family with a 16 track recorder!

If noise gates are all they are cracked up to be, surely they can be used to overcome other audio problems. In fact, used correctly, they are most useful in many places. Perhaps the most useful is in the modern PA system. For many years PA systems have suffered under the brunt of user abuse. They are blamed for picking up all manner of noises on stage which were never meant to be heard; annoying footsteps, rustling papers, background murmurs, and so on.

If the system has several microphones, it usually takes a very experienced operator to find the culprit microphone and turn it down before the disturbance has come and gone. Here, a noise gate can be inserted, and its threshold level set to be significantly below normal operating levels. The result is dead quiet until the user steps up and starts his performance.

Another specialised field is rock music PA systems. It has been my experience that rock vocalists invariably position the guitar amplifier speakers directly behind the PA microphones and then proceed to compete with the combined effect of all these amplifiers, to make themselves heard on the PA system. Why can't they move their amplifiers off the microphone axis? Apparently the psychology of a rock vocalist is such that he simply cannot "get it all together" unless the amplifier is right behind his ears. The problem can be overcome in some cases by inserting a noise gate, and setting the threshold level significantly higher than for normal PA work so as to gate out the background level of the guitar amplifier. This solution may well be simpler than convincing the vocalist of his obvious error!

The above examples of noise gate uses are just the beginning. In fact, for audio devices of any kind, a noise gate is a handy piece of gear. It almost leads to the question — why hasn't someone published a circuit before? Well, certainly not because it's too complicated, as the published circuit shows. The idea, in fact, may be implemented quite simply.

It is desirable to consider just what electronic specifications such a device should have. First, the all-important threshold level. For a specific application threshold level may be fixed but, if the unit is to serve many purposes, threshold should be variable. The threshold of the unit described here is continuously variable.

The next most important considerations are attack and decay time; the time required to switch out the attenuation, and to restore attenuation, respectively. It may be found that, for minimum distortion, the attack time should be as short as possible, and the decay time relatively long. Decay

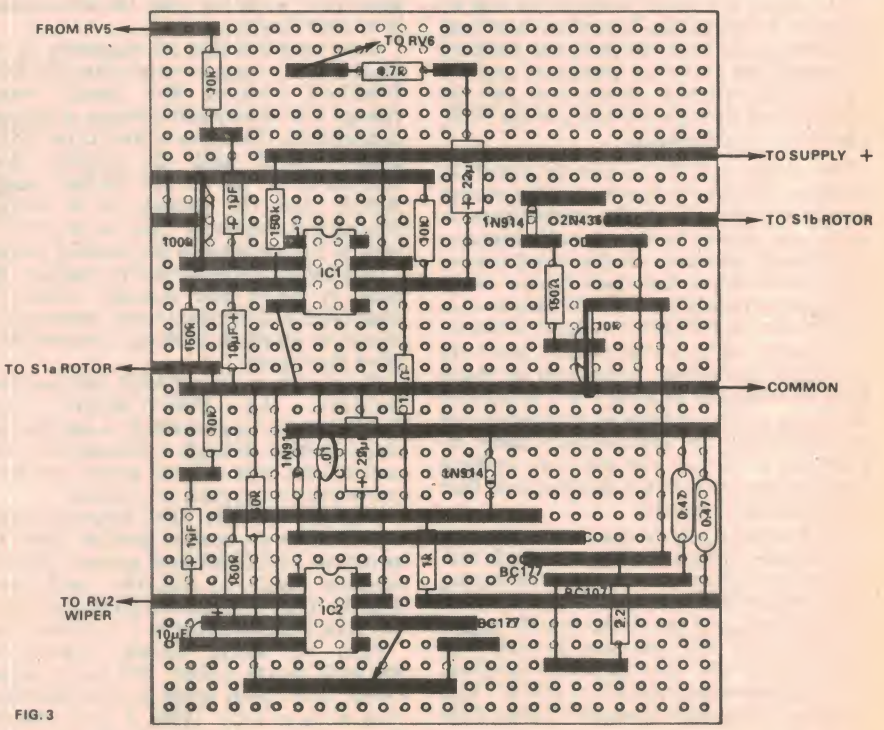


FIG. 3

The original was built on a piece of Veroboard measuring 2.7in by 3.4in and having 0.1in spaced tracks. This diagram shows the layout from the component side. Readers with the necessary facilities could doubtless evolve and make their own printed board.

*320 Maundrell Terrace, Apsley, Qld, 4034.

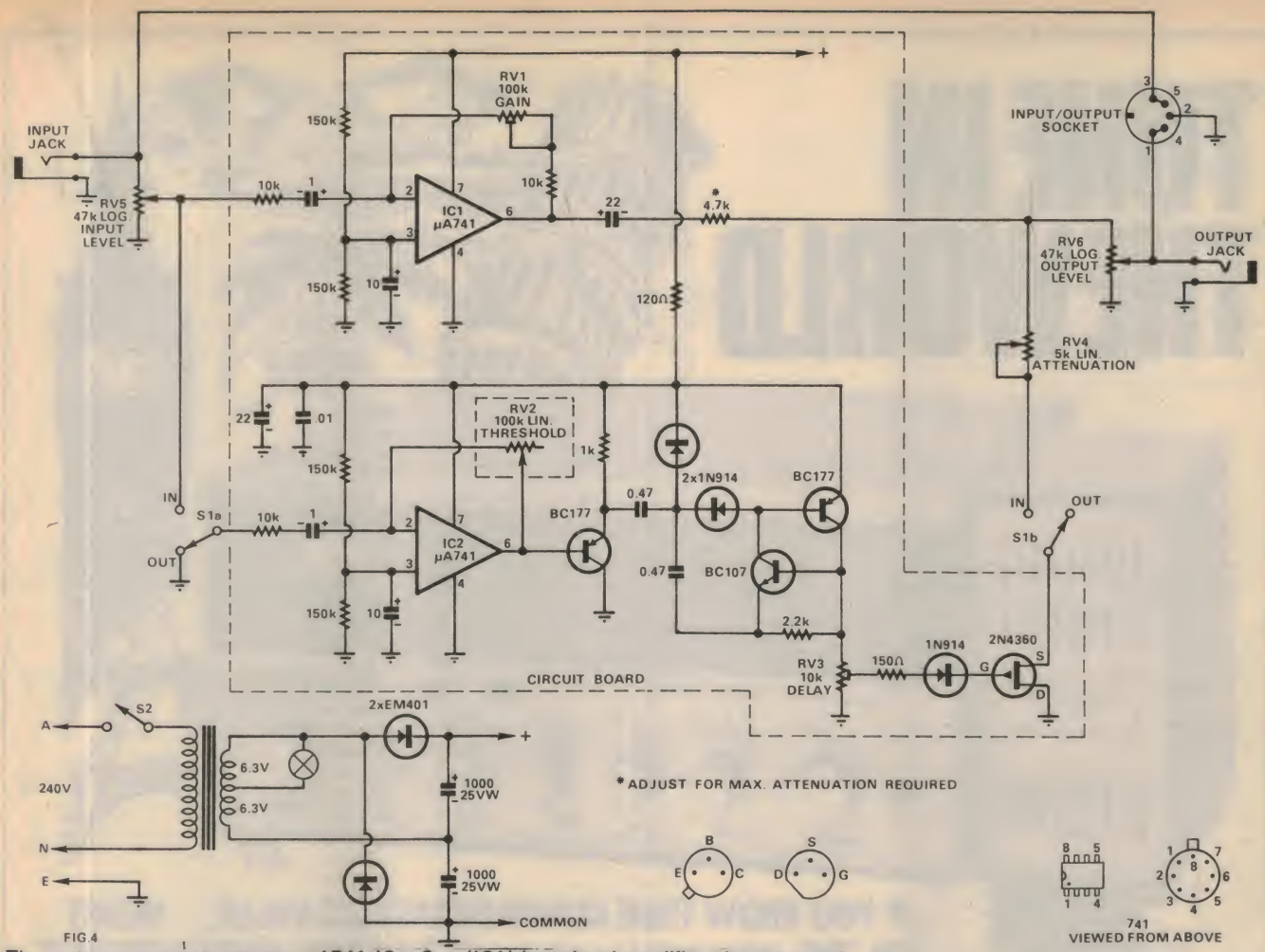


FIG.4

The main components are two uA741 ICs. One (IC1) is a signal amplifier, the output of which is controlled by an attenuator formed by RV4 and the 2N4360 FET. The resistance of the FET is controlled by bias derived from IC2 and its associated network.

time also must be capable of accommodating any quiet passages which may occur between program peaks.

The noise gate described here has an attack time of less than 1mS and a decay time of about 1 second. The decay time may be adjusted by varying a pot, as described later.

Next to be considered is the amount of attenuation switched in while the gate is operative. As this depends on the application, it has been made variable via a front panel control.

Some thought must be given also to the levels the unit must handle. The circuit shown here has unity gain in its normal state, although provision is made for a voltage gain adjustable up to 10. Input and output attenuators allow the respective levels to be trimmed. It is designed to handle signals at medium audio level, ie, around 0.5V.

A description of the circuit is as follows. The first op-amp (IC1) is a simple inverting amplifier, the gain of which may be adjusted by means of the 100K preset pot (RV1). The input signal is split to the second op-amp (IC2) whose gain is controllable via RV2, forming the threshold control. The output of this amp is fed via an emitter follower (BC177) and a rectifier network to a complementary pair of transistors forming a switching circuit which, due to the DC conditions, cannot latch on. When the signal exceeds the turn on point the .47uF capacitor (C1) discharges and the BC177 turns on, and the FET is gated off. The resistance of the FET increases from a few hundred ohms to several megohms, thus removing the attenuator formed by RV4, and the FET. If the signal level falls below threshold, the .47uF capacitor (C1) is required to be charged via the BC177 collector load. This charging time gives the decay time delay. Hence RV3 sets the delay, as it regulates the voltage of which the FET will again switch on.

Fairly substantial power supply filtering is required to ensure switching transients are not coupled to the audio circuitry.

Construction is as per the drawings. The case chosen was a simple metal and plastic one measuring 19.5cm x 11.2cm x 6cm.

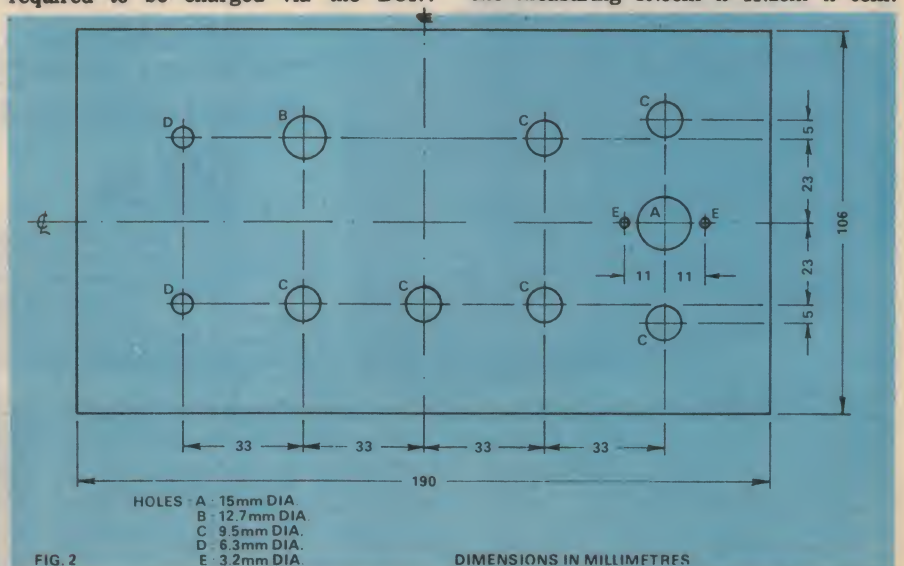


FIG. 2

Drilling details and other dimensions for the front panel. Comparison with the label on the next page will help identify the various control positions. Some hole sizes may have to be varied to suit the components available.

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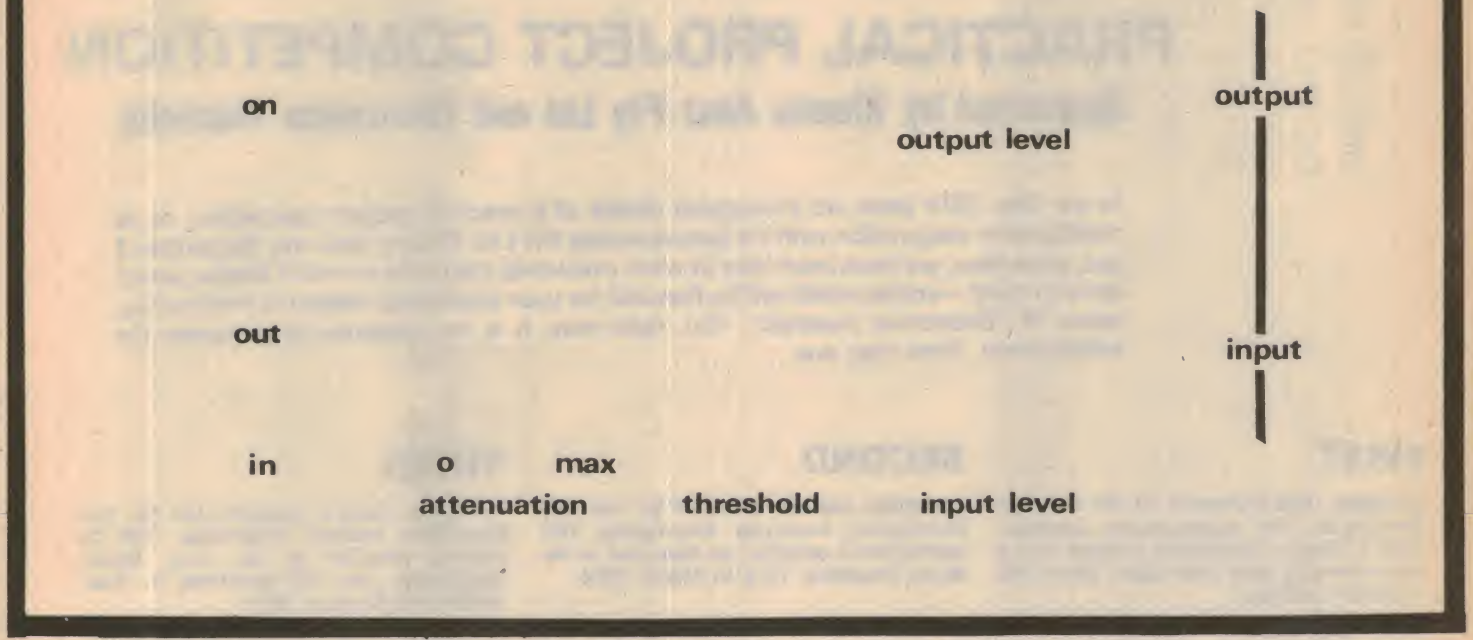
audio noise gate



Above: Suggested design for the front panel, shown full size. Constructors may prepare their own, using Letraset, but we regret we cannot supply any additional artwork. Below: Graph showing typical input/output relationship of the Noise Gate.

Dimensions for drilling the aluminium panel are given in Fig. 2. The major control components are mounted on the rear of the aluminium front panel, and the power transformer, supply components and component board within the plastic case body. The component layout may be according to the veroboard pattern given (Fig. 3), or on a printed circuit. The prototype used stereo jacks to accommodate ring, tip, and sleeve plugs, and a DIN connector for in and out functions on the one socket. The label on the prototype was printed onto SCOTCHCAL plastic and the artwork is given.

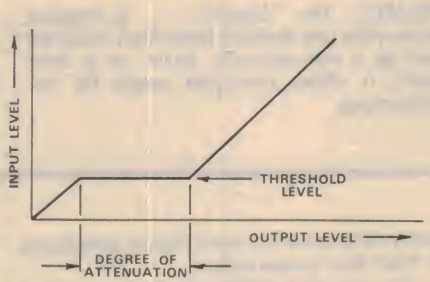


FIG. 1

Setting up and use of the unit is fairly simple. RV1 should be set to the required gain through the unit and RV3 to about mid position for a normal decay time. RV5 and RV6 may then be set to accommodate the peripheral equipment. The setting of RV2 and RV4 depend on the application. The following procedure may be used. Determine the normal operating level of the system with the noise gate cancelled. Apply signal at about half the normal level. Set RV4 to maximum, switch in the noise gate and advance the threshold (RV2) until the level reappears. Back off the level until the noise gate triggers and advance the level again to just under the switch off point. Reduce RV4 to the required attenuation point. An audio oscillator is not mandatory but simplifies the procedure somewhat.

Having produced the basic unit, which works quite well, a number of possible improvements suggest themselves, but which the author has not had time to investigate.

These are:

(a) A better regulated and smoothed supply, probably using an IC regulator, eg, from the uA7800 series.

(b) A single uA739 in place of the two uA741s, to give better noise figures.

(c) A calibrated switched attenuator in place of the attenuation pot.

(d) A LED indicator to show when the gate is operative.

The uses of the noise gate are many and varied, and limited only by the user's ingenuity.

PARTS LIST

1 PF2851 transformer
1 Veroboard 2.7in x 3.4in x 0.1in
1 DPDT miniature toggle switch
1 SPDT miniature toggle switch
1 Indicator bezel
1 Case (see text)
1 DIN connector
2 Jacks
Knobs, wire, power cord etc.

RESISTORS
All ¼w, 5% unless specified
1 120 ohm ½W
1 150 ohm
1 1k ½W
1 2.2k
1 4.7k
3 10k
4 150k
1 100k trimpot
1 10k trimpot
1 5k "A" taper pot
1 47k "C" taper pot
1 100k "A" taper pot

CAPACITORS
1 .01uF 50V Hi-K ceramic (redcap)
2 0.47uF 50V polyester
2 1uF 25V electrolytic
2 10uF 25V electrolytic
2 22uF 63V electrolytic
2 1000uF 25V electrolytic

SEMICONDUCTORS
2 uA 741 ICs
1 BC107 transistor
2 BD177 transistors
1 2N4360 p-channel FET (or similar)
3 1N914 diodes
2 EM401 diodes

Note: resistor wattage ratings and capacitor voltage ratings are those used in the prototype. Components with higher ratings may generally be used provided they are physically compatible. Components with lower ratings may also be used in some cases, providing ratings are not exceeded.

The Winning Entries:

PRACTICAL PROJECT COMPETITION

Sponsored by Kitsets Aust Pty Ltd and Electronics Australia

In our May 1974 issue we announced details of a practical project competition to be conducted in conjunction with Kit-Sets Australia Pty Ltd. Closing date was September 2 and, since then, we have been hard at work evaluating the many excellent entries which came to hand — entries which will be featured for your continuing interest in forthcoming issues of "Electronics Australia". But, right now, it is our pleasure to announce the prizewinners. Here they are:

FIRST

Complete build-it-yourself kit for the E.A. Playmaster 140 quadraphonic amplifier, with 4 Plessey loudspeaker systems and a record playing deck with stand, cover and magnetic cartridge.

Mr. I. Robertson,
20 Harper St,
HELENSBURGH, NSW 2508.

PROJECT: An unusual test probe for logic circuits capable of depicting directly five states: logic high or 1, logic low or 0, short to positive, short to negative, and open circuit.

SECOND

Complete build-it-yourself kit for the Electronics Australia Playmaster 140 quadraphonic amplifier, as described in the issues December 1973 to March 1974.

Mr. J. Pittar,
19 Edmondson St,
CAMPBELL, CANBERRA 2601.

PROJECT: The "Dauble" — a musical device with pre-settable tones that could be used as a non-alarming alarm, or a door "bell". It offers unlimited scope for experimenting.

THIRD

Complete build-it-yourself kit for the Electronics Australia Playmaster 136 2-channel amplifier or its more recent counterpart, the 143 described in September and October 1974.

Mr. R. M. Torkington,
103 Sutling St,
CHAPEL HILL, Qld 4069.

PROJECT: A very simple and inexpensive audio glide tone generator which automatically and repetitively scans the audio band. Handy for assessing performance of domestic hifi systems.

HOW THE COMPETITION WAS JUDGED

On receipt, entries were checked to make sure that they had been posted on or before the closing date. They were then placed in a folder to await examination and judging.

With all the entries in hand, an editorial executive conference agreed on a basis on which submissions would be judged: interest, originality, design merit, presentation, cost factor, etc. Each factor was given an appropriate weighting.

All entries were then read by the Editor-in-Chief, Neville Williams, who marked a score sheet in terms of these individual qualities from poor through to excellent.

The entries were read and scored a second time by the Assistant Editor, Philip Watson, independently and without consultation. This done, the score sheets were totalled, compared to resolve any glaringly different reactions, then averaged to determine an initial order of merit for all entries.

The top ten were then passed over to a panel headed by Editor Jim Rowe for further reading and close examination, and this yielded the three provisional place getters. As a final step, the three entries were prepared for publication — aimed at uncovering inherent weaknesses and indicating, in the most practical way, how much extra work our staff had to contribute to their final presentation.

It was only after taking this final step that we fixed the order of the winning entries, as above.

THE ENTRIES, AS PUBLISHED

All entries were judged strictly on their merit in the form submitted, and to the conditions set out in our May issue.

They will not necessarily be published in this form.

Where appropriate, our technical staff will consult with the contributor, re-draw diagrams, and modify text to present the idea to best advantage.

What you will read, therefore, is not the entry as submitted, but as prepared for publication.

TECHNICALLY SPEAKING

The projects which have come out of the competition have been developed by individual readers and, as such, should appeal to other enthusiasts — either in the original form or as a source of ideas.

But remember: the units have not been through our laboratory and should not be regarded as regular "Electronics Australia" projects. We will therefore not be in a position to answer postal queries about their operation, or supply back-up information, diagrams, etc, beyond what is published. And while we may quote the contributor's name and address, to authenticate the article, the contributor is under no obligation to answer letters about his project. That is entirely a matter of his own inclination and convenience.

EACH MONTH

We plan to publish selected projects from the many entries received. We think you'll find them interesting because they represent the separate and independent ideas of enthusiasts throughout Australia and New Zealand. To make sure that projects are presented to best advantage, contributors are invited to forward supplementary text, pictures or diagrams for possible inclusion in the original article. Remember that, while you may not have been among the prizewinners, "Electronics Australia" will pay normal space rates upon publication.

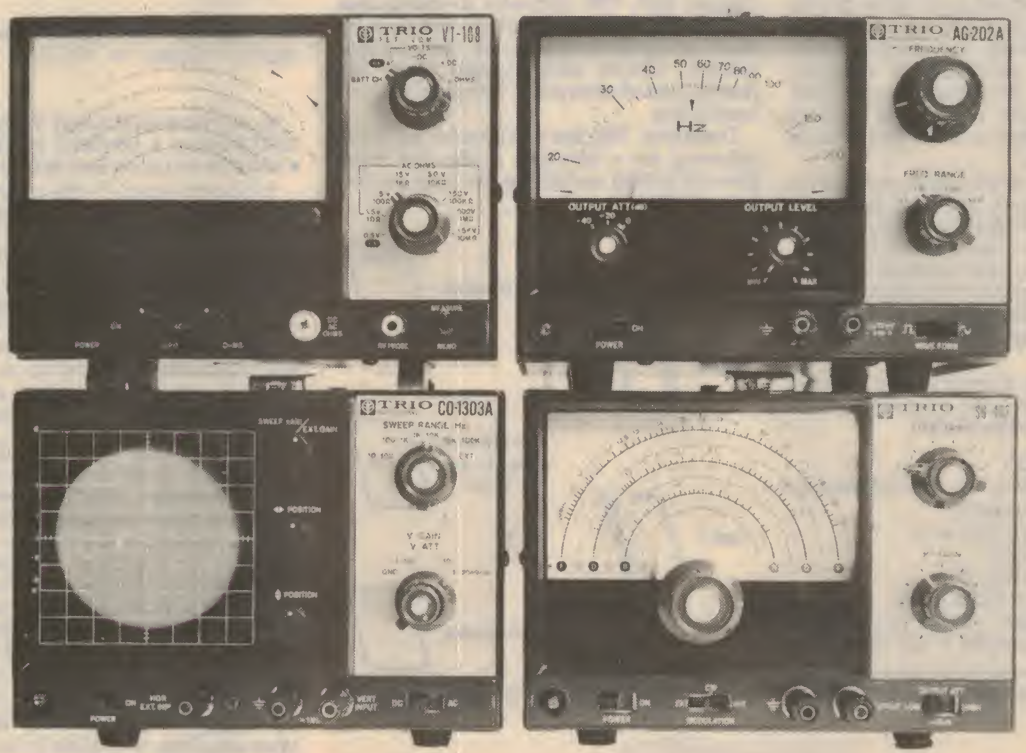
Professional Trio Test Gear at Amateur Prices

VT108FET Volt-Ohm-Meter $75*

DC volt meter:	
Range:	0.5 to 1,500 V in 8 ranges.
Input impedance:	11 MΩ on each range.
Accuracy:	±3% at full scale
AC volt meter:	
Range (Sine wave voltage):	1.5 to 1,500 V r.m.s. full scale in 7 ranges
(dB):	−15 to +66 dBm
(Any other voltage):	4.2 to 4,200 Vp-p full scale in 7 ranges
Input impedance:	1 MΩ 80 pF at 500 to 1,500 V range 145 pF at 1.5 to 150 V range using (PC-14) probe
Accuracy:	±5% at full scale
Freq. response:	15 Hz to 5 MHz ±10% 30 Hz to 2 MHz ±3%
Ohm meter	
Range:	0.1 Ω to 1,000 MΩ in 7 ranges.
Accuracy:	±5% of setting range at scale 0.3 to 3 ±10% of setting range at scale 0.1 to 10
Memory	
1% scale variation:	Approx. 30 sec.

AG202A Audio Generator $82*

Frequency range:	20 Hz to 200 kHz in 4 ranges
Freq. accuracy:	±(3% + 2 Hz)
Sine wave characteristics:	
Output voltage:	10 V r.m.s. ±10%
Distortion:	0.5% at 50 Hz to 100 kHz 1% at 20 Hz to 200 kHz
Square wave characteristics:	
Output voltage:	10 Vp-p
Overshoot:	3%
Sag:	10% at 20 Hz
Output impedance:	600 Ω
Output attenuation:	HIGH/LOW (40 dB) and variable control
Drift with line voltage:	(±10% variation) Freq: ±0.5% Level: ±0.5 dB
External synchronization:	
Synchronization voltage:	1%/V approx.
Max. input voltage:	3 V r.m.s.
Input impedance:	10 kΩ



CO1303A 75mm Scope $149*

CRT:	C308P1
Vertical Sensitivity:	20 mV/cm
Attenuator:	1/1, 1/10, 1/100 plus fine control.
Bandwidth	DC: DC to 1.5 MHz (−3 dB) AC: 2 Hz to 1.5 MHz (−3 dB)
Input R and C:	1 MΩ, 30 pF
Max. input voltage:	300 V (DC + AC peak) or 600 V p-p
Horizontal Sensitivity:	500 mV/cm
Attenuator:	Continuously variable
Freq. response:	DC to 250 kHz
Input R and C:	1 MΩ, 40 pF
Sweep Freq:	10 Hz to 100 kHz in 4 ranges
Synchronization:	Internal (−)
Power requirements:	100/117/230 V AC 50/60 Hz, 15 W.

SG402 R.F. Generator $66*

Freq. range:	100 kHz to 30 MHz in 6 ranges
Freq. accuracy:	±1%
Output Voltage:	0.1 V r.m.s.
Attenuator:	HIGH/LOW (10:1) and variable control.
Modulation:	
Internal:	400 Hz, 40% mod. degree
External:	Requires 1.5 V r.m.s. for 40% mod. degree
Power requirements:	100/117/230 V AC 50/60 Hz, 6 W.
Dimensions:	W 186 mm x H 131 mm x D 220 mm (W 190 mm x H 154 mm x D 245 mm Max. dimensions)
Weight:	2.5 kg

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Winner of the Kitsets-EA Project Competition:

5-state logic probe has 7-segment readout

Here is the project which won first prize in the Kitsets/Electronics Australia competition. For anyone working with logic circuits, it should be invaluable. Detecting no less than five distinct logic conditions, it indicates them simply and elegantly using a 7-segment readout.

by I ROBERTSON*

The probe in use. Readout is via the 7-segment display on the end.

The logic probe described is the latest in a line of probes I have constructed. Working with industrial control equipment using TTL devices I have tried most available logic probes and noted the following:

Probes including pulse stretching circuitry can be a problem as it often proves necessary to move the probe supply leads to the IC being tested, to prevent false triggering. Where stretching is included, provision to disable should also be provided.

Secondly the probe must show a large number of logic states or it will be put aside for an oscilloscope.

Finally the probe must obtain power from the circuit under test, be hand held, and have protection on the input and output against the most common forms of abuse.

The probe developed is unusual in that it will detect 5 logic states and display these on a 7 segment LED display. For details of the display and logic states covered, see Fig. 1.

Pulse stretching circuitry was omitted from this device, as I use a separate probe for this form of measurement.

INPUT DETECTION

Individual detectors for the following 4 logic states are provided.

1. Short to positive (TR2 & 3)
2. True logic '1' (TR4)
3. True logic 'O' (Gate B1)
4. Short to negative (TR6 & 7)

The 5th state (open circuit or incorrect logic level) is displayed if all the above states are absent.

Detecting a short to positive or a short to negative relies on a similar arrangement, and only the short to negative circuit will be detailed.

Transistors TR6 & 7 form a Schmitt-Trigger with TR6 normally in conduction. Placing the probe on a voltage less than the 50mV dropped across the 10 ohm emitter resistor, diverts base current from Tr6, taking it out of saturation, bringing TR7 into conduction.

Transistor TR5 has a dual role, normally behaving as a blocking diode, but when forward biased cancelling the base emitter drop of TR6.

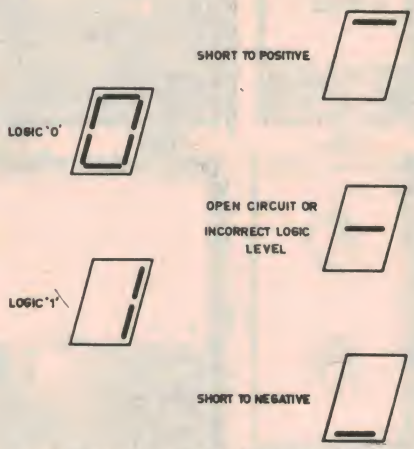
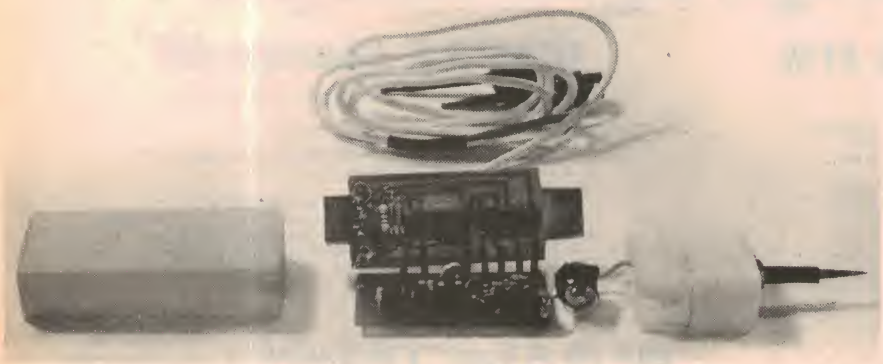


fig. 1: Readout of the 5 states detected.

*20 Harper Street, Helensburgh, NSW 2508.



The probe opened up. Built inside a miniature torch case, it has all of the circuitry on two small PC boards.

To activate the Schmitt-Trigger the probe must contact a potential below 50mV with a shunt resistance less than 10 ohms.

To detect logic '1' the emitter follower TR4 drives a standard TTL input. Whereas a gate will respond to logic '1' and open circuit in a similar manner, TR4 will only follow a true logic '1'. The base emitter drop of TR4 also ensures a full logic level must occur to initiate a change of state.

Logic level 'O' is taken to a standard 74 series gate input for detection. Including a diode in series with the gate reduce the 'O' level accepted to the worst case level.

OVERVOLTAGE PROTECTION

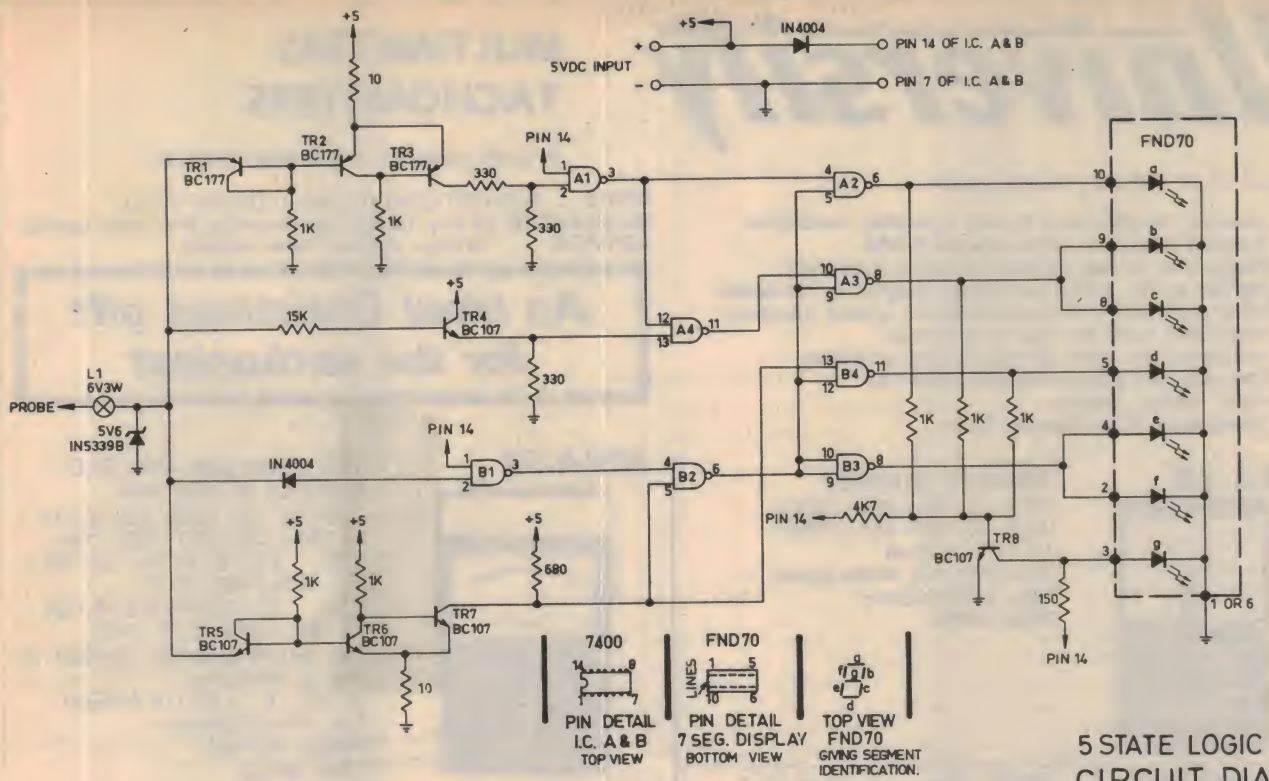
The input probe is by-passed by a zener diode, thereby limiting the maximum voltage to reach the input detectors to 6 volt positive and 0.5 volt negative. Lamp L1 is the load for the zener, having resistance below 2 ohms in normal use, but increasing to 25 ohms with 20 volts on the probe. Fusing of the lamp takes place as the voltage increases. These components are for protection only and voltages above 5 volts should be avoided in normal operation.

Protection from reversal of the supply takes the form of a diode in series with the IC positive pin. Provided the reverse voltage does not exceed 5 volts it is not necessary to similarly protect the input detectors — indeed the short to positive detector would cease to function with diode protection.

OUTPUT DECODING

With detection of the input states completed the information enters a gate network for decoding to a form suitable for the 7 segment display. The gates determine which segment (or segments) should be illuminated for a given input. In addition, only one level must be displayed at a time.

The short to negative or positive rail is only a specialized instance of a logic 'O' or '1' and hence more than one input detector will be activated by a short condition.



5 STATE LOGIC PROBE
CIRCUIT DIAGAM

The complete probe circuit. There are four detectors, two for the "short to rail" states. Circuit is fully protected.

However the gating is arranged so the short detectors override the normal logic detectors.

Four gates decode segments 'A' through 'F' while segment 'G' (open circuit indication) is controlled by TR8. The latter transistor by-passes all current from segment 'G' while any other segment is illuminated.

The display segments are driven directly from the TTL outputs, current limiting being effected by the internal level '1' gate resistance. The circuit has been arranged so that the power dissipation is divided equally between ICs A and B.

The brightness difference that should in theory result from operating certain segments in parallel while others are driven singly, is not discernible in operation.

GENERAL INFORMATION

A few points may not be clear from the foregoing description.

A short to rail value of 50mV / 10 ohms was taken rather than a true short circuit. This overcomes any voltage drop on the supply lines and enables input protection to be incorporated. In practice the "0" level will always exceed 50mV and a "1" level — even in open collector applications — will be many times this value below the rail voltage.

The input loading of this device is 1UL for all conditions excepting a short to positive or negative rail. It is assumed any short to rail will pass the extra 5mA required for these detectors.

Supply current for this probe can reach 100mA, and while in most instances this will be available from the unit under test, it can be provided by a separate battery or supply. However if this is done, ensure that the negative of the extra supply is interconnected with the negative of the unit under test.

The 7 segment display legend, while being easily interpreted is also capable of being read upside down. To prevent ambiguity the top and bottom should be identified by a red dot placed adjacent to segment 'a' and a green dot placed adjacent to segment 'd'.

CONSTRUCTION DETAILS

The accompanying photographs give an idea of construction used for the prototype. The components are mounted on two PC boards measuring 28mm wide by 50mm long. A miniature plastic torch case is used

PROBE PARTS LIST

2 PC boards, as described
1 FND 70 7-segment display
2 7400 quad 2-input gate
5 BC107 (PC107) transistors
3 BC177 (PC177) transistors
2 1N4004 (1N5060) diode
1 1N5339B 5V6 Zener diode
1 6 volt 3 watt lamp
2 E.Z. Mini Hooks
2 10 ohm ¼ watt resistors
1 150 ohm ¼ watt resistor
3 330 ohm ¼ watt resistors
1 680 ohm ¼ watt resistor
7 1K ohm ¼ watt resistors
1 4.7k ohm ¼ watt resistor
1 15K ohm ¼ watt resistor
1 Penlite torch 20 x 35 x 95mm
1 Shielded mic. Cable (1 metre long)

The man behind this project

Ian Robertson, who won the Kitsets-EA Practical Projects Competition with the logic probe design presented here, is employed as a Technical Officer in the R&D section of Elevators Pty Ltd, a major Australian lift manufacturer. He is currently involved in the development of solid state lift control systems.

Apart from his prize-winning competition entry, Mr Robertson has had previous designs published in our "A Reader Built It" section, fore-runner of the current "Circuit and Disign Ideas" column.

As well as his interest in electronics, both professionally and for pleasure, he is also a keen photographer, taking both 35mm slides and super-8 movies.

Upon learning of his success in the competition, Mr Robertson expressed his thanks to Kitsets Australia Pty Ltd and the magazine for making the competition possible. He was looking forward to

assembling his Playmaster 140 quadraphonic system, and enjoying its impressive performance.

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ACV: 1.5 / 3 / 5 / 10 / 25 / 50 / 125 / 250 / 500 / 1kV
DCA: 25 / 50uA / 2.5 / 5 / 25 / 50 / 250 / 500mA / 5 / 10A
Res: Rx1,Rx10,Rx100, Rx1000 (1 ohm to 16M ohm)
db: -20 / 0 / +62 (10 Ranges)
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Weight: 530 gm
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DCV: 2.5 / 10 / 50 / 250 / 500 / 5kV
ACV: 10 / 50 / 250 / 500 / 1kV
db: -20 / 0 / +62 (5 ranges)
DCA: 50uA / 5mA / 50mA / 500mA
Res: Rx1,Rx10,Rx100,Rx1k ohms (1 ohm to 10M ohms)
Size: 150x110x50mm
Weight: 450 gm
Price $16.00

MVA-100

100K ohms per Volt D.C.
PROFESSIONAL QUALITY
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ACV: 2.5 / 10 / 50 / 250 / 1000
DCA: 10uA / 500uA / 5mA / 500mA / 10A
ACA:10A
Res: Rx1, Rx10, Rx1k, Rx10k Rx100k (.2 ohms to 160M ohms) (5 ohms to 200M ohms)
db: -20 / 0 / +62 db (Ref. 1mW in 600 ohms)
Dimensions: 178x133x76mm H.W.D.
Weight: 1.36 Kg
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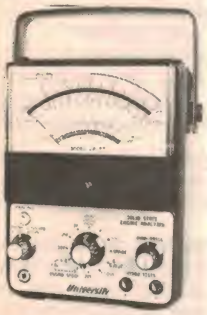
EA-77



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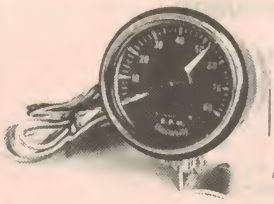

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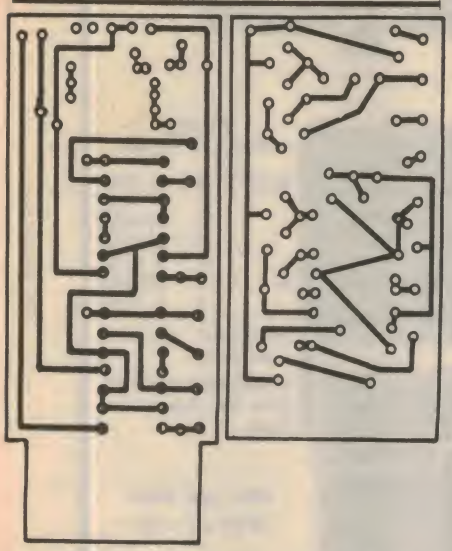
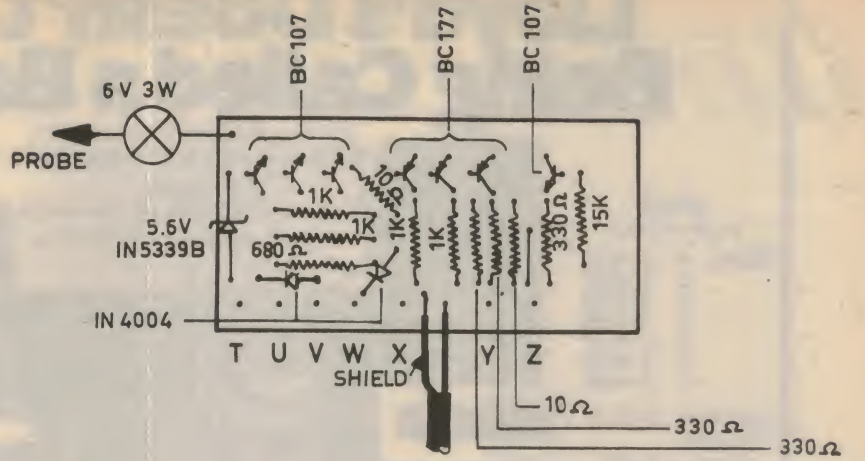




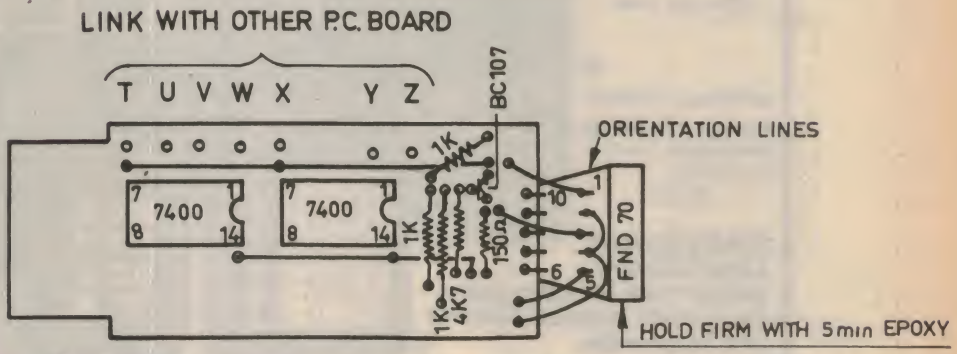
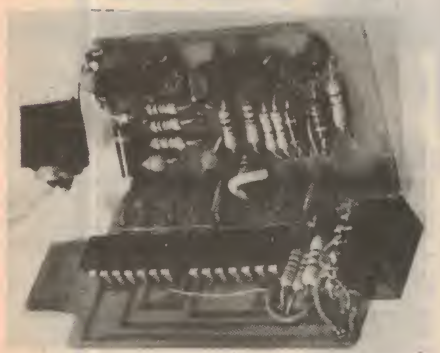


Fig. 2 (above): The PC board patterns, shown actual size. Below is a close-up of the wired-up board assembly.



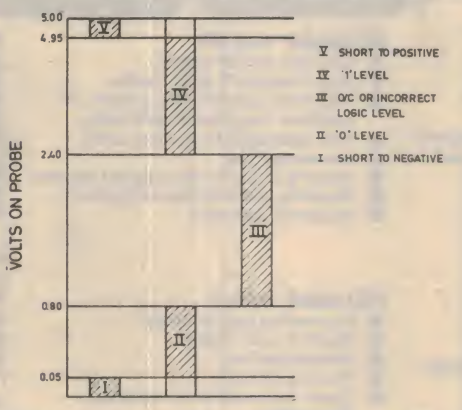


Fig. 3 (above): Wiring diagrams for the two PC boards, also showing interconnections. Fig. 4 (left): The voltage levels which define the five states detected by the probe.

as a housing, requring only the addition of a probe at the reflector end, and a hole for the 7 segment display to be viewed at the opposite end.

Approximately a metre of shielded cable is provided or the power lead, this terminating with E.Z. mini hooks or similar.

Detail of the PC boards and their assembly is given in Figs. 2 & 3. Care should be taken to keep all components as close to the PC boards as possible or trouble may occur when fitting the boards into the housing. Metal can transistors will require an insulating sleeve to prevent adjacent cans shorting.

The layout of the PC boards enables the component sides of each to be placed together, with the higher components falling into clear areas on the other board. Seven wire links joining points T through Z hold the boards at the required spacing, while also allowing the assembly to fold apart for repair. Resistor pigtails covered with PVC sleeve can be used for the links.

The miniature torch case used to house the probe cost 35 cents at a local hardware store. The torch is also stocked by Radio House Pty Ltd, and at a cost of $1.00, I imagine they are still available. Made in Hong Kong, they carry a trade mark consisting of a cup or urn bearing the letter V.

To modify the torch, remove the switch assembly, the lamp contacts and the lamp from the front section, also remove the battery bridging piece from the body. Then make a probe by filing a point on a 3/16in Whitworth screw, about 50mm long. The probe mounts in the hole which originally held the lamp. Include a cup washer on the outer face, to obtain a surface on which the holding nut can sit.

The body section requires a hole at the end to clear the 7-segment display. Take care when forming this hole, as the plastic is easily cracked. I recommend that you make the hole with a hot soldering iron, finishing off carefully with a small file.

The 7-segment display should be adjusted to pass through the hole in the end of the torch body, before being glued to PC board number 1. Use 5-minute epoxy adhesive such as that made by Selleys Ltd, applied around the pins and connecting wires.

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Fast recovery rectifiers

A short article explaining what these devices are, how they differ from normal diodes, and their applications.

A silicon rectifier cannot make an instantaneous switch from forward conduction to reverse blocking. For a momentary period, prior to full blocking, the rectifier is a short circuit, conducting current freely in the wrong direction while the electrical charge that has been built up by forward conduction is "swept out."

In typical "slow" recovery silicon rectifiers, the time required for the rectifier to recover and perform its blocking function may be from 5 to 50 microseconds. In some types of applications, this may be too slow for efficient rectification. Furthermore, it results in a reverse spike of considerable energy which may be highly undesirable in certain conditions and applications.

The period of time required for a silicon rectifier to develop its blocking ability after switching from forward conduction is termed "reverse recovery time," trr. Fig. 1 shows a typical recovery waveform for a rectifier, and how trr is measured. The actual time required for recovery will vary

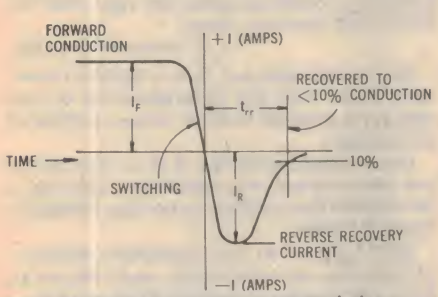


Fig. 1: Diode recovery characteristics.

depending on the amount of forward current passed before switching; frequency or rapidity of switching; wave form (sine, sawtooth, or square); impedance of recovery current loop; reverse voltage applied; temperature; and, most important, the type of rectifier used in the circuit.

Manufacturers usually do not give trr specifications for the slow recovery rectifiers, and where there is no major effort made to control this particular characteristic, recovery time will not be consistent from one device to another. Typical values fall between 5 and 50 microseconds. Occasionally it is possible to select enough relatively fast rectifiers from a large lot to meet a particular applications requirement.

A rectifier is usually classified as "fast recovery" if it has a trr specification of less than 1 microsecond under specified test conditions. Fig. 2 shows a typical test circuit.

Basic process changes must be introduced in device manufacture in order to produce a rectifier with fast recovery characteristics. The most common technique is diffusion of minute quantities of gold into the silicon junction structure before actual device fabrication.

Difficulties encountered in this process are basically those of control: the amount of gold applied to the silicon; gold diffusion time and temperature; silicon surface preparation before and after gold diffusion; silicon slice thickness; and previous diffusion steps required to form the rectifying junction. Each of these control points is critical.

The increased level of control (reflected to some extent in lower yields) and the additional process steps result in increased manufacturing costs and somewhat higher selling price.

The actual physical phenomena that result in a reduction of trr are beyond the scope of this note; it should be recognized, however, that decreasing recovery time for a given rectifier type generally results in an increase in forward voltage drop, an increase in reverse current, and a decrease in peak inverse voltage, PIV.

Forward voltage drop will be slightly higher (about 20pc) at current less than, or equal to, rated values on fast recovery devices than with similar slow recovery devices; under surge conditions it will be considerably higher (up to 100pc). Reverse current is approximately an order of magnitude higher than in similar slow recovery types. Maximum peak reverse voltages for fast recovery junctions are only about 70pc of that for slow recovery devices. All of these are reflected in data sheet specifications.

This means, for example, in a high voltage stack rated for a particular voltage, more junctions are required for a fast recovery type than for a slow recovery type.

Applications

The most obvious applications for fast recovery rectifiers are those involving high frequencies where slow recovery devices produce low rectification efficiencies, and overheat due to internal losses. Generally speaking, for rectifier purposes high frequencies may be defined as the band from 10kHz to 200kHz.

In addition, wave forms such as sawtooth or square waves have high frequency components, even though the repetition rate is low, and often require fast recovery

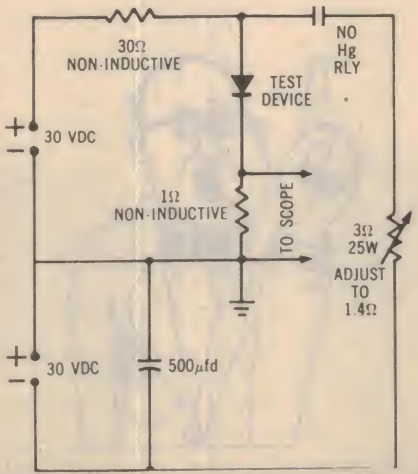


Fig. 2: Typical recovery test circuit.

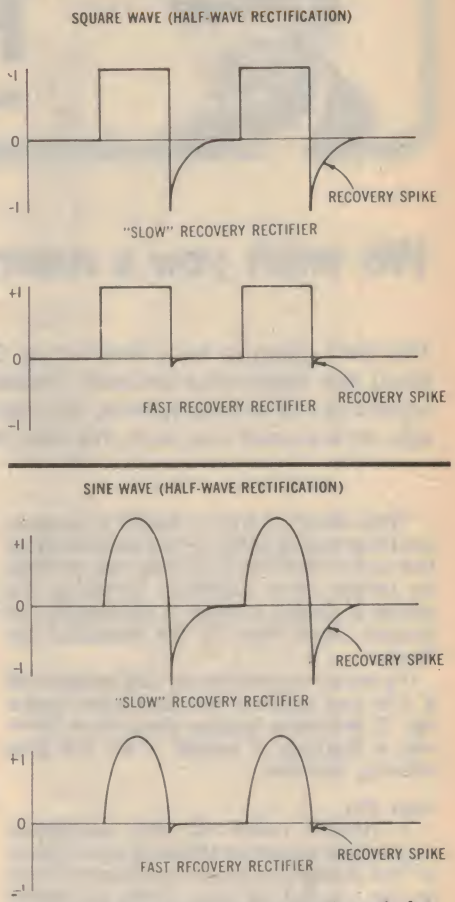


Fig. 3: Comparison of normal and fast recovery rectifiers with square and sine waves.

rectifiers for satisfactory operation.

Actual rectification efficiencies are not easily determined analytically; the best practical method of determination is insertion of the rectifier in the actual circuit and observation of performance.

There is a group of applications for fast recovery rectifiers which is less immediately obvious. The reverse recovery "spike" itself has a high frequency content and therefore is a source of noise and radio frequency interference, RFI. Since RFI is related to spike energy it can be reduced quite effectively through the use of fast recovery rectifiers, which can result in a reduction in the amount of supplementary RFI filtering required.

The spike-reducing characteristics of fast recovery rectifiers may also improve the ripple characteristics of DC power supplies (particularly with square wave inputs), while maintaining minimum values on filter components. This can mean savings in parts costs as well as significant contributions to size and weight reduction.

Fig. 3 illustrates typical square wave and sine wave forms with slow recovery and fast recovery rectifiers.

(Adapted from an applications bulletin published by the Semiconductor Division of Varo, Inc., Texas, by arrangement with their Australian representatives R & D Electronics Pty Ltd, of P.O. Box 48, Dee Why NSW 2099).

Forum

Conducted by Neville Williams

We wish you a merry Christmas ... Ugh!

This isn't going to be a very happy Christmas for quite a few people in (or from) the electronics industry, poised somewhere between retrenchment, retraining and re-employment. But just when we were trying to find the bright side, so we could look on it, this letter arrived!

"This letter" is from a reader in Queensland disgruntled partly by the current situation in the electronics industry but, as well, by longer term situations involving the status of people trained in electronics, as distinct from those in the electrical industry.

It's not a new problem by any means and it was very much to the fore a few years ago. It seemed to quieten down when there was a shortage of people to fill the jobs offering, but now. . . .

Dear Sirs,

A phrase which all the electronics magazines have been throwing about lately is "the Australian electronics industry"; this in the context of such items as tariffs, unemployment and colour television. But let me ask you: what is the Australian electronics industry?

For an industry you require people clearly related to that industry. But do we have distinct electronics tradesmen, electronic apprentices or even electronic engineers? No! What we do have is a conglomerate of people from various trade backgrounds masquerading as TV servicemen, calculator servicemen, &c.

Let me ask: How can we have a growing, viable industry if its identity is blurred under a mass of bull dust and red tape, stemming largely from the electrical trades?

As an example of this administrative "hoo-haa" let me quote my own case. I have completed the Electronics & Communications Certificate in NSW but of what good is it to me in my present environment? The electrical authorities here do not recognise it as being equal to an agricultural electrician and I am not permitted legally to work on any mains operated equipment.

In one place where I was employed, I was not allowed to use a multimeter on the premises but I could use a CRO or a digital multimeter to measure the same — and any number of kilovolts or amps!

In practical terms, as a qualified electronics technician, my recognised level of competence is below that of a first year electrical apprentice — and this is common throughout the industry. The position of "electronics technician" is not recognised (in Qld anyway) so the holders are marshalled into the category of technical officer or technical assistant.

By contrast, the electrical people arrange for their troops to acquire a modicum of electronics or instrumentation, after which they are called instrument tradesmen or electrician special class, with corresponding pay rises! But these same people have to rely on humble, lower-paid radio mechanics or "technical assistants" to repair and maintain their test equipment, as the circuitry is a bit too complicated for them!

Even the so-called Australian electronics industry seems, by and large, to suffer from an electrical bias. I have yet to see an Australian capacitor really suited for a PCB; they seem to be designed for electricians and process workers soldering with blow torches! One large Sydney company I worked with used process workers to repair 2-way radios and supplied them with large wooden-handled irons to use on printed boards.

How agricultural!

What about the electronics media? Years ago, there was a change from R.TV & H to "Electronics Australia" but you have never defined this title. Perhaps you are still under the electrical trades aura. What about your staff? Do any of them have any formal training in electronics, or have you converted over from electrical or even bush carpentry?

Nothing personally, fellas, but this is what I am getting at: You might be suppressing the electronics industry unconsciously, as a side effect of your basic training. It's time the popular media followed the move of the institutes and came out of the "technical only" shell and started pushing a definite electronics policy.

Do you want to continue as "Electronics Australia" or as "Special Class Electricians Australia"?

It's time also that the Australian governments and authorities up-dated themselves in this respect. Then perhaps the industry as a whole could become viable, rather than secondary to the electrical trades.

Your magazine, and others, should solicit articles from people responsible for the training and assimilation of electronics personnel at all levels, and also from the regulatory bodies in regard to their policies.

You should publish articles from companies producing components (especially capacitors); this should start people thinking about tariffs, etc. Your magazine would then truly represent "Electronics Australia", giving readers an insight into the whole scene.

Articles on training might possibly encourage more youth into the industry to replace those in the 40/50 year bracket that you mentioned in a recent editorial. The youth of today like to see where they are going, especially if they have to work at it, but who is showing them the way into the electronics industry now?

I.M. (Hermit Park, Qld)

Electronics! What's electronics? Why don't you get yourself a real profession?

Well, as you can see, that is quite a broadside, fired with the determination of one who feels himself to have been a victim of the system.

It may be argued that I.M.'s statements are too personal, too emotional; that he is too close to the problem to be able to see the broader issues.

That may be so, but discussion between parties who are spectators, each secure in their own position, can be just the reverse — impersonal, unemotional, prepared to debate the broader issues interminably, while the people most concerned suffer and fret.

While readers may want to react in particular ways to I.M.'s statements, I personally am not sure how many of his problems flow from the authorities, how many from those in charge of workshops, and how many from the workmen themselves by way of demarcation boundaries. Broadsides may serve a purpose but they are more effective if appropriately aimed.

Again, reading through I.M's letter, I wonder whether he would be more tolerant, more-open hearted than those he condemns. If he had his way, I wonder what confines he would impose upon electricians? Would he deny them access to "electronic" techniques? What would the situation then be in the reticulation area, for example, where electrically trained people are doing their traditional thing, aided by electronics?

My own reaction is that it is becoming progressively more difficult to draw any kind of a hard line between "electrical" and "electronic". This doesn't mean that I see electronics becoming absorbed into electrical; one could argue just as convincingly that the reverse is happening. What it really means is that the two are merging because of technological pressures, and they will continue to merge, notwithstanding definitions or pockets of resistance on both sides.

Whether they like it or not, electrical people cannot do without electronics,

because electronics is invading their traditional fields of activity.

And, whether they like it or not, electronics people cannot expect to be above and exempt from safety regulations and conventions when they look like getting involved with mains wiring and appliances.

The immediate problem is where you draw the lines, whether you have agreed areas of overlap or whether you require that, for every job near the interface, you must have an electrician and an electronics man working side by side!

The equivalent happens, of course, in industries a lot older than electronics, so there is plenty of precedent for suspicion, confrontation and silly situations.

One other aspect of this matter should be considered. I.M. is totally concerned with the electrical / electronic interface, because that is the environment in which he finds himself. But the all-pervading nature of electronics and its penetration into just about every other activity is producing many other "interfaces", with their own potential problems.

Consider the medical field and the vast amount of electronic equipment being developed for analysis, diagnosis and patient care. Do you turn "raw" electronics technicians loose in the wards, or insist on a modicum of medical training? Or do you start with medically trained people and teach them a modicum of electronics? How do you classify people with these hybrid skills, and on what do you base salary levels?

What about electronics and plant research, electronics and quality control, electronics and automation, and so on?

If we scaled up I.M's argument to keep pace with electronics itself, half the work force in developed countries would end up as electronic tradesmen, technicians, engineers, etc, but specialising in medicine, plant research, quality control, automation, computation, aviation, and what have you. Outside this basic core would be electricians who merely string wires, medicos who remain aloof from electronic gadgetry, and figure men who use a scratch pad, a slide rule or an abacus!

Who knows; there may be people in other interface areas who are just as unhappy as I.M. It is even possible that some people trained in these other skills are looking with a very jaundiced eye at the invasion of the electronic types, with their transistors and their whatnots.

It's over to you!

One final thing: where do the electronics media stand?

We can only speak for ourselves. We changed our name to "Electronics Australia" at a time when the word was entrenched far less firmly than it is now.

We dropped general science, mechanics and model making, and adopted the guideline that editorial material must, in future, relate in some way to electronics or its applications.

As for staff, our prime requirement has been that they have a feeling for electronics, can work with electronics and can write about the subject. They have had (or have) a variety of qualifications or may, perchance, have graduated from bush carpentry! We impose no constraints, and suffer none.

The basic requirement is that they do a job.

We have an "electronic" name, a totally electronic posture, and a staff selected for their electronic know-how. I doubt that I.M. can really sustain his suspicion that, somehow, we are unconsciously suppressing the electronics industry — at least in the technical area.

He may, however, seek to maintain that we suppress electronics by not publishing more on industry organisation and politics — this for subtle emotional reasons.

If reasons are needed, they would be entirely pragmatic. To remain viable, we have to produce a product that people will buy and, in the present context, this means a magazine with a technical rather than an industrial image.

We certainly would not automatically discard industry orientated material, as evidenced by the reproduction of I.M's letter. But the simple fact is that we seldom have to exercise the option; very few of the people within the industry, in a position to explain their activities, views and convictions, show the slightest inclination to do so. Are they busy or lazy? Or do they see the problems as having a much lower profile than I.M. pictures?

Again, it's over to you.

Quite by chance another letter received this month comes from someone with a point of view almost diametrically opposite to I.M. — an electrician. It is reproduced below. The sincerity of the writer and his reason for writing are both laudable, yet by implication he rules out the idea that electronics workers — even engineers — should be allowed to fit even a power plug or flex.

Dear Sir,

What is being done by the appropriate authorities to protect fools from themselves, as well as innocent parties?

I refer to the amount of time spent in framing safety codes, which prohibit the unauthorised wiring of buildings or equipment, along with other ideas to ensure the safe use of electricity.

While these codes have apparently been framed by well meaning persons, their efforts have been nullified in part by their own failure to control the resale of items such as cable, flexes, power point combinations, extension sockets &c, all of which are readily available over the counter in chain and hardware stores.

The immunity of these retailers from prosecution is ludicrous when one considers the consequences to a manufacturer, contractor, qualified mechanic, fitter or technician, should a fatality occur which can be attributed to negligence.

I am a qualified electrical fitter by trade, conducting my own business servicing electrical equipment, and the times are numerous that I have been asked to check and repair equipment "because I got an awful shock".

In my opinion, there is no room for untrained or unqualified resellers of the abovementioned items.

L. L. (Cowra, NSW)

The Serviceman

Rank using vertical stripe tube

One of the most recent colour TV sets to appear on the Australian market is the Rank Arena, made by Rank-NEC Pty Ltd at their Penrith factory, about 45 kilometres west of Sydney. The writer was recently privileged to see over this factory and study their 22in receiver, the 2201.

The new company is a joint venture between Rank Industries Australia Pty Ltd and the New Nippon Electric Company Ltd, and has been inexistence only since March of this year. Separately, of course, both companies and their affiliates have had a long experience in the electronics industry, and have large technical resources on which to draw.

Considering the short time which has elapsed since the company was formed, it is a creditable achievement that they officially opened their factory on 11th September and were then in limited production. When I visited the factory a couple of weeks later I was shown the areas set aside for a large expansion program, aimed at bringing the factory up to full production. A lot of this will have been achieved by the time these notes are published.

As well as the electronics section, the factory has its own cabinet making division, making both TV cabinets and high fidelity speaker cabinets.

From a technical and servicing point of view the 2201 has a number of interesting features. Probably the most interesting is its use of a vertical stripe tube, with in-line guns, as opposed to the more conventional triad dot structure and delta gun configuration.

It is now considered that this class of tube will dominate the next generation of colour TV sets, being well established in the USA, Europe and Japan. However, its advance has been so rapid that, until recently, it was not expected to be available for the first generation Australian-made sets. Now, at the time of writing, both Rank-NEC and one other company are planning to use it.

Initially, it will be available only in the 22in size. For their 26in model Rank-NEC will be using a conventional triad tube with a modified chassis. However, they hope that by early next year the 26in vertical stripe tube will be available, making possible a universal chassis for both size sets.

This tube offers a number of advantages. One is a more effective coverage of the tube face with the three colour phosphors, resulting in an increased light output of nearly 30pc. Since limited light output has always been a problem with colour tubes, this is a worthwhile achievement.

Another factor contributing to increased light output and better contrast is the black matrix technique, used in both triad and vertical stripe tubes. This provides that the areas between dots or stripes is coated in black. This allows the full area of the phosphor to be excited without risk of exciting adjacent areas, thus increasing brightness. In addition, by reducing reflection from those areas which are not used, it darkens the screen. This produces better blacks and, as a result, better contrast under high ambient light conditions.

The second main advantage concerns the in-line gun configuration. In a monochrome tube the gun is located in the ideal position; directly opposite the centre of the screen. But in a colour tube there are three guns to accommodate and, fairly obviously, not all of them can occupy this ideal position. At best, only one can and, in a delta type tube, none of them does. The closest is the blue gun, which is central on the vertical axis, but below the horizontal axis. The red and green guns are each on opposite sides of the vertical axis, and above the horixontal axis.

The result of locating any gun off axis is to produce a geometrically distorted picture; something akin to a keystone effect. Try locating a slide projector well away from the centre of the screen and note what happens to the normal rectangular shape of the image.

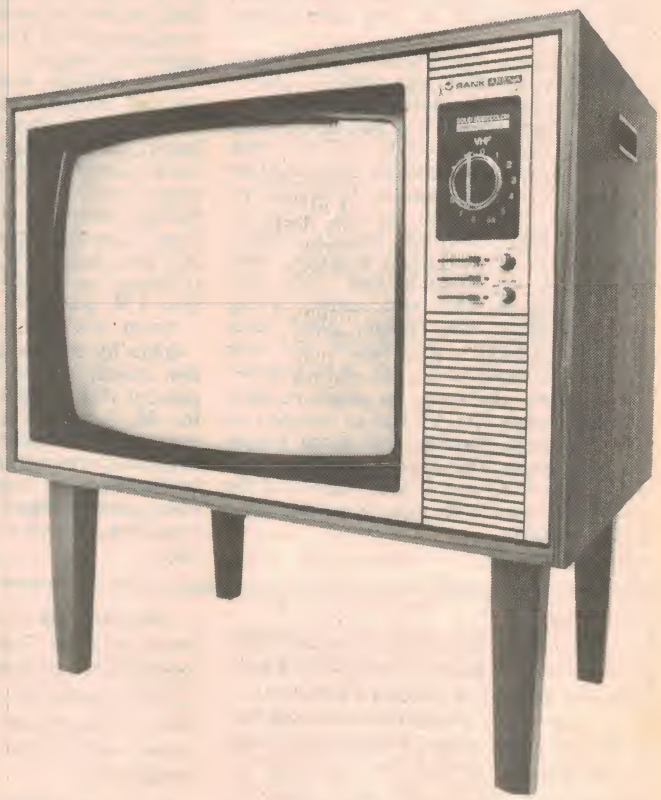
In the delta tube all three images are distorted, and all in different directions. As a result, the only place where the three images would correctly superimpose is at the centre of the screen.

To correct this, a correction coil is provided for each gun. To each coil is fed a correction waveform derived from the vertical and horizontal deflection systems. The waveform for each coil must be individually generated, and adjusted, so that it makes all three pictures the same size and shape and, therefore, coincident.

The circuitry required to do this is quite complex and its adjustment critical. The whole subject comes under the heading of convergence.

The in-line gun configuration, while not a complete cure, is a worthwhile step in the right direction. With this system one gun (usually the green) occupies the ideal position dead centre, while the other two are located to each side of it. Thus all three guns are on the correct horizontal axis, and only two of them are displaced from the vertical axis. Correction waveforms are required for only two guns, and these waveforms need to provide correction in only one axis.

As a result, the convergence circuitry is much simplified and, therefore, potentially more reliable. And, when it does have to be adjusted, the adjustment is similarly simplified.



Front view of the Rank receiver. The three horizontal slide controls are, from the top, "colour saturation", "brightness" and "contrast". The upper of the two knobs to the right is the volume control/power switch, the lower one the "manual/auto" switch used in conjunction with the fine tuning control.

Apart from the type of tube and its associated convergence circuitry, the set is fairly conventional. It uses 52 transistors, 61 diodes, and seven IC's. Of these latter, one is used in the sound IF system, three in the video IF system, and three in the chrominance board.

The set is constructed on a number of printed boards which, in line with modern practice, can be easily unplugged and replaced with a new board in a matter of minutes. The makers will provide a

replacement board service or, if the serviceman prefers, he may repair the board himself and use it as a replacement in a subsequent job. Where the fault is obvious or easily detected, the serviceman may prefer to replace the faulty component on the spot, and the construction of most boards is sufficiently open to allow this.

The power supply was something of a surprise. It uses a conventional 50Hz power transformer, bridge rectifier, and voltage regulator. The makers admit that this makes the set heavier than those using high frequency systems, but point out that it is also a simpler arrangement and should, therefore, be more reliable.

Another minor surprise is the audio output stage. In place of the now almost universal class B push-pull system, it uses a single high voltage transistor in class A, working from a 100V rail, and coupling to the speaker via an output transformer; an arrangement which looks surprisingly like the single ended valve stages of old.

The output stage is direct coupled to a single driver stage; a low voltage transistor coupled, via the volume control, to the sound IF integrated circuit. It is difficult to imagine a simpler arrangement.

The set is constructed on a chassis which is roughly "U" shape. The bottom of the "U" rests on the bottom of the cabinet, with the two upright portions parallel with the sides of the cabinet.

The sets being produced when I visited the factory used cabinets deep enough to enclose the entire chassis, and were fitted with a flat rear panel. To gain access for service, three screws are released which allows the chassis to be pulled free of the cabinet. The serviceman is then looking down inside the "U" and has ready access to all boards.

This cabinet is shortly to be replaced with a shallower model, fitted with a moulded plastic cover at the back. In this design, removal of the cover will provide immediate access to the chassis, without the need for it to be moved.

The convergence controls are mounted on a hinged panel which can be swung up over the top of the cabinet so that they are readily accessible from the front of the set; an essential requirement for ease of convergence adjustment.

The set features a minimum of user controls on the front of the cabinet. Apart from the tuner, there is a combined volume control and ON / OFF switch, brightness control, contrast control, and colour saturation control. The latter is the only new control.

On the rear of the chassis are the vertical and horizontal hold controls, and a colour tone control. The latter is a simple DC control circuit connected to the grids of the red and blue guns and permits a slight shift in colour balance. Although accessible to the user, we imagine its main use will be to provide a final touch up during installation, or to compensate for any slight drift in other components with the passage of time.

From a servicing point of view we imagine it would be a useful feature, providing a simple solution to a disgruntled customer who complains of a picture that is consistently too red or too blue — regardless of how accurate it might be!

The set is designed to virtually eliminate errors in setting the fine tuning control. The tuner is fitted with a fairly conventional fine tuning control of the type which, once set for a particular channel, "remembers" that setting whenever that channel is selected.

This is backed up by an automatic fine tuning (AFT) circuit. Signal at the video IF (36.875MHz) is fed to a ratio detector which generates an error voltage if the IF is incorrect. This is fed back to the tuner and corrects the local oscillator frequency.

Thus, if the tuner is correctly set up at the time of installation, there should be no need for the customer to have to worry about the fine tuning control at all.

Two sets of aerial terminals are provided; one for 300 ohm ribbon and one for 75 ohm coax. There is also a "LOCAL / DISTANCE" switch to cope with very strong signal areas.

Quality control has obviously been given a high priority in this company's production planning. There are the usual intermediate tests of sub-assemblies as they are produced and adjusted, plus progressive tests as the chassis moves down the production line.

As it comes off the production line it rolls into a rather fearsome looking jig, the like of which I have never seen before. It grasps the chassis firmly between two horizontal plates, one above it and one below, turns the chassis upside down, and administers a mighty jolt. Then it turns it right way up and jolts it again. The idea is to shake loose any foreign matter — solder, scraps of wire, screws etc — and also to reveal any other physical shortcomings.

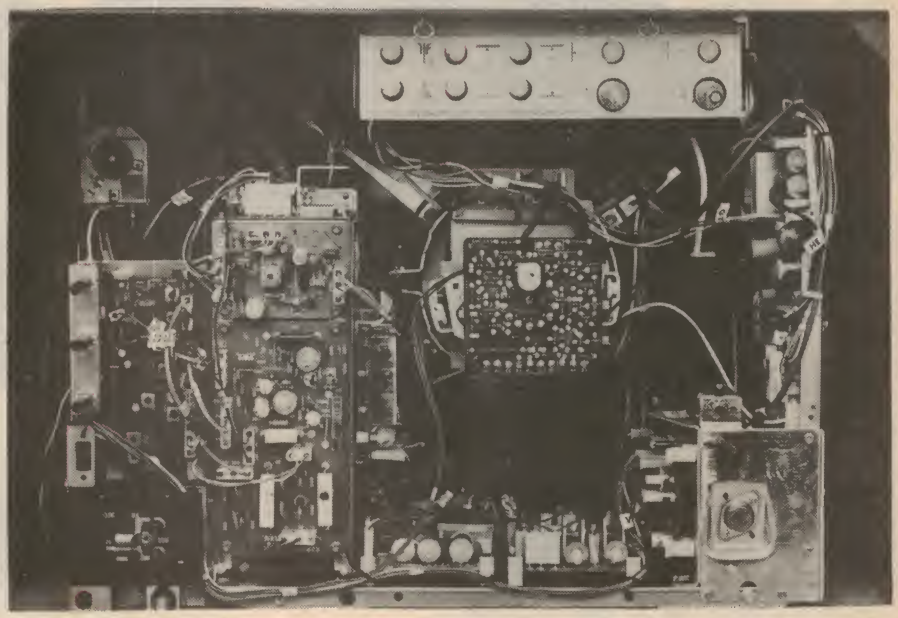
As this was being explained to me I couldn't help thinking that these chassis could fairly be described as "pre-thumped". So, if you're tempted to bash the side of the cabinet when you first encounter one of these in need of attention, think again. The makers have already done this for you; better reach for the multimeter!

Seriously though, remembering some of the faults and foreign objects which I have found in sets, this will probably prevent a lot of trouble in the field.

After cabinet fitting the sets are put on "heat soak"; usually for about eight hours, more if the production schedule permits. From there they go to final test.

Those which pass final test are normally packaged and prepared for despatch, but the checks are not yet finished. Beyond the final test point is another quality control section; a test room at virtually laboratory standard.

At odd intervals the technicians from this section pick a packaged set at random, unpack it, check that all accessories, literature etc has been included in the carton, then proceed to give it a prolonged test and thorough overhaul. As a variation on this, sets may sometimes be recalled from the despatch department proper.



Rear view of the Rank receiver. At top left is the tuner, below it the PAL decoder, and below this again the aerial input terminals and "Local / Distance" switch. Next on the right is the power supply (large lower board) and the IF system (small upper board). Mounted horizontally is the chroma board and the video output board. At extreme right is the deflection board, with the horizontal section at the bottom. The horizontal deflection transistor is clearly visible. The convergence adjustments are suspended from the top of the cabinet, and may be swung up to provide access from the front.

Any faults which turn up during such tests are fed back to the production line and steps taken to prevent their recurrence. In the event that a trend should become evident, more serious steps would be taken.

To assist dealers and servicemen to make the conversion to colour the company has trained a team of field instructors who will be conducting one day service instruction seminars at major metropolitan and country centres.

Sets are also being supplied to technical colleges and lectures have been arranged through dealer and serviceman representative organisations. The company also has its own service department, functioning as a back up for dealers or servicemen who find themselves with a service problem with which they cannot cope. In short, a comprehensive organisation right along the line.

The service manual is most comprehensive. It consists of 57 pages plus two foldouts; a block diagram and full circuit diagram. It gives details of all installation and service adjustments, including convergence, IF alignment, chroma section adjustment, PAL decoder adjustment, pincushion adjustment, as well as the more usual AGC, height, width, linearity, and similar adjustments.

(Cont. overleaf)

THE SERVICEMAN

The circuit is complete with a waveform chart — some 57 waveforms — plus very comprehensive voltage data. Voltages are quoted at all IC pins plus most transistor pins, together with the main supply rails.

The copper pattern of each board is reproduced, with the components and their code numbers superimposed on it. These code numbers are repeated on the boards themselves, as well as in the main circuit diagram. With the exception of a couple of very simple board patterns, these are given for both the copper side and the component side.

One page is devoted to the connections for all transistors and ICs used in the set. This followed by a brief summary of the PAL colour system, followed by a more detailed description of the PAL decoder and chrominance circuits used in this set. Following sections describe the sound and video IF systems — including the automatic fine tuning circuit — and the chroma circuitry.

There is a replacement parts list, listing every component together with the part number (for ordering), description, the quantity used in the set, and the code number as shown on the circuit etc.

To sum up: A set with several very worthwhile features, not the least being the vertical stripe black matrix tube, and the automatic fine tuning circuit. A set which appears to be well made, well tested, and to have a high order of reliability built in. Above all, it has a full scale service and spare parts backing and has been designed to make service as simple — and therefore as economical — as possible.

While on the subject of colour sets, you may find some customers confused by the two popular tube sizes, 22in and 26in, currently being quoted. If you are asked, the following comments may help.

On the face of it, they may be pardoned for imagining that a 22in tube would be at least comparable with, say, the old 21in or 23in tube they have been nursing along until colour arrived.

But on seeing a 22in tube their immediate reaction is that it is a good deal smaller. And this is no optical illusion, as a tape measure will quickly confirm.

A 21in tube, as typically masked, gives a picture 15in high by 19½in wide. By comparison, the 22in tube screen is 13½in high by 18in wide.

How come?

There are two reasons:

(1) A change of aspect ratio from the old, incorrect 4/5 to the correct 3/4.

(2) The much straighter sides of the modern tube.

Both these factors increase the diagonal measurement, without necessarily increasing the height or width. The most striking example is the 26in tube. This is 15in high and 20½in wide; the same height as the old 21in, and only 1in wider.

The extra width is due mainly to the changed aspect ratio, giving the viewer that portion of the picture which, in the old tubes, had to be masked off. More importantly, the definition provided by the 26in tube should be essentially the same as that from a 21 or 23in. Any extra picture area comes from salvaging that which was previously wasted.

Circuit & Design Ideas

Conducted by Ian Pogson

Interesting circuit ideas and design notes selected from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Your contributions are welcome, and will be paid for if used.

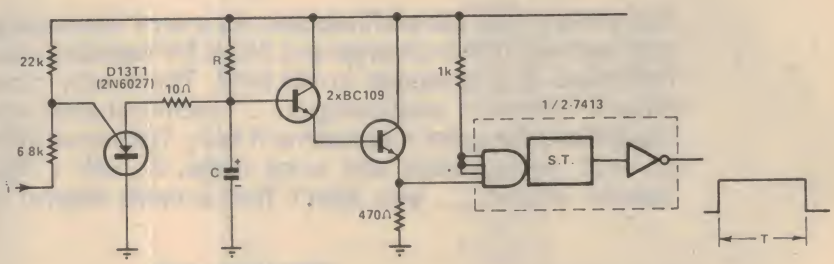
Long period TTL monostable or delay

It is not easy to obtain delay times or pulse periods of more than a few hundred milliseconds using a normal TTL monostable IC such as the 9601 or 9602. Where a period of up to about 30 seconds or so is needed, I have found the circuit shown to be worthwhile. It uses only a handful of low cost parts, yet can be readily adjusted over a wide range.

Basically the circuit uses a simple R-C timing circuit connected to the 5V supply rail. A Darlington emitter follower stage monitors the capacitor voltage and drives one of the two Schmitt trigger elements from a readily available 7413 device. With the capacitor C normally charged, the output of the Schmitt trigger is thus normally low, because of the inversion in the 7413 output circuit.

A D13T1 or 2N6027 programmable unijunction is connected across the capacitor, however, and the PUT can be triggered into conduction by means of a short negative logic input pulse applied via the 6.8k resistor to its anode gate. The PUT then fires, discharging the capacitor almost instantaneously. The output of the Schmitt trigger thus goes high.

When the capacitor voltage drops below the PUT conduction threshold, and when the input pulse has ended, the PUT turns off. The capacitor then starts to recharge through R. Only when its voltage reaches about 1.2V higher than the threshold of the Schnitt trigger input does the output drop back to the initial low state. (The 1.2V margin is due to the Vbe drops of the two Darlington transistors.)



Capacitor C may be almost any value, from a few hundred pF to 47uF or higher, but it should be a low leakage type. For the higher values, a tantalum electrolytic would be desirable. Resistor R may be any value up to about 1M, or even higher if high-gain BC109C transistors are used for the Darlington pair to give them a very high input resistance. The effective period of the circuit with 1M and 47uF is about 35 seconds.

The 10 ohm resistor in series with the anode of the D13T1 is to limit the peak discharge current to a safe value. It is really only necessary for values of C above 5uF, and may be omitted for smaller values.

Continuous adjustment of the period may be achieved by making R variable. Thus a combination of a 470k pot in series with a 47k resistor, with a 47uF 6VW tantalum electro, gives a period adjustable from about 2 to 20 seconds.

(By Jamieson Rowe, E-A staff)

Synchronous audio noise blanker

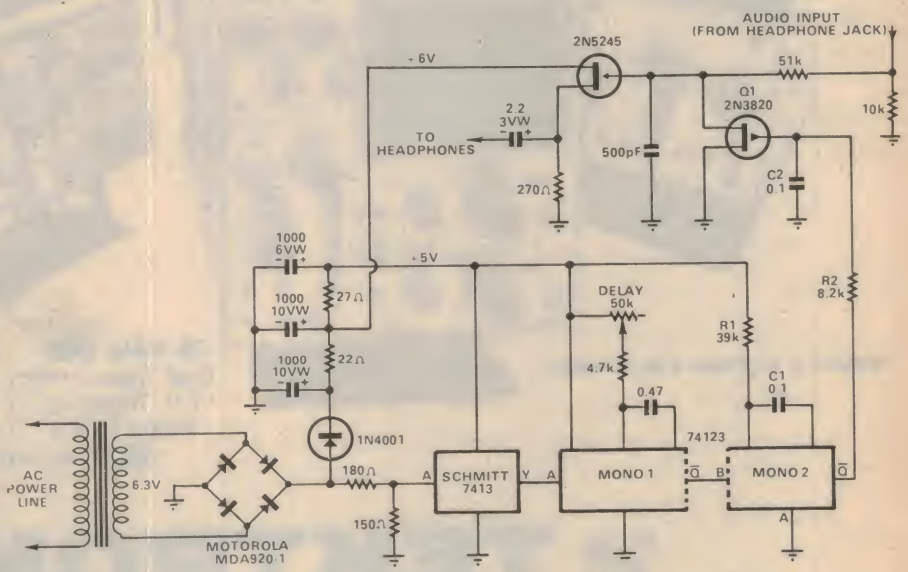
Fluorescent lights, gas rectifiers, neon lamps, SCRs and triacs all produce a substantial RF signal that often radiates through their power line connections and interferes with nearby communications receivers. This type of radio interference desensitises the receiver and seriously degrades the recovered audio.

The noise pulses produced by power line radiation occur at a repetition rate of twice the power line frequency. Since the noise blanking circuit is driven by the same power utility as the noise source, the output signal from the bridge rectifier section of the noise blanker will have the same rate as the noise pulses.

The source of the blanking pulses therefore, is independent of the input audio signal. The blanking pulses cause the FET gate (Q1) to conduct to silence the receiver. Since the blanking pulses are not derived from the input signal, their timing does not depend on the shape and rise time of the noise pulses, nor is it affected by the modulation characteristics of the desired signal.

The output of the bridge rectifier is shaped by a Schmitt trigger that drives a dual monostable multivibrator. The first monostable (MONO1) delays the blanking pulse, which is produced by the second monostable (MONO2), relative to the output of the rectifier. The delay is variable so that the blanking pulse can be positioned to coincide with the noise pulse.

The width of the blanking pulse is determined by resistor R1 and capacitor C1.



The fast rise time of the blanking pulse (from MONO2) is slowed down by the low-pass filter formed by resistor R2 and capacitor C2, thereby minimising the distortion of the recovered audio signal.

(By M. J. Salvati, in "Electronics".)

You won't find a better bunch of 'scopes for love nor money.

Technicians who use oscilloscopes are a very interesting bunch of fellows too, with a common interest and desire for technical excellence. Yet every individual is a specialist in his field. That's why more top technicians choose Tektronix oscilloscopes . . . technical excellence and specialised capabilities for every measurement task. Tektronix offers the best 'scope in your performance and price range. So call a Tektronix Sales and Service office . . . you won't find a more helpful bunch of fellows.

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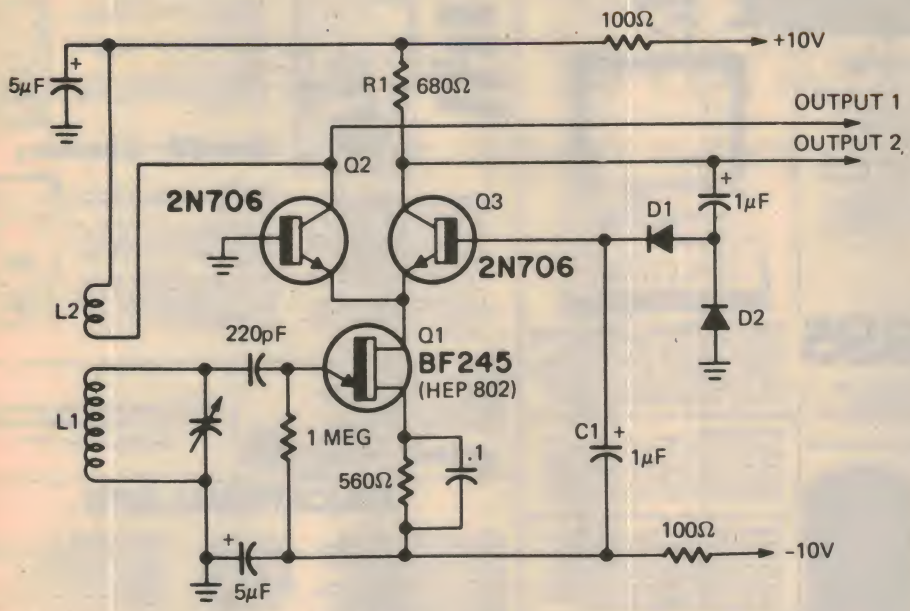
Unusual L-C oscillator



D1-D2 = SILICON DIODES

The novel oscillator circuit shown in the diagram was designed for constant amplitude across its tuning range. The oscillator, described in T.E.S.T., a magazine published in Paris, France, for service technicians, was designed especially for use in test instruments, but can be used in receivers and other devices where its characteristics are needed.

Transistor Q1 is a FET, but a bipolar transistor can be used instead. Q2 and Q3 form the amplitude regulator. The drain current of Q1 is held constant at a level just high enough to sustain oscillations. This constant current is supplied through a split path consisting of L2-Q2 and R1-Q3. Path L2-Q2 forms the feedback loop needed for oscillation. D1 and D2 rectify a portion of the RF signal at the collector of Q2, to develop a base bias for this transistor.

When power is first applied to the circuit, Q3 is blocked because its base-emitter voltage is at, or close to, zero. The full drain current for Q1 flows through L2 and Q2. When the circuit starts oscillating, Q3 conducts sporadically. The voltage developed across R1 is rectified by D1-D2, filtered by C1 and used to bias the base of Q3 positive.

The greater the voltage drop across R1, the more will the current of Q3 increase. Since the drain current of Q1 is constant, any current drawn through R1 must be subtracted from that available through L2-Q2 to sustain oscillations. Thus, when Q1 output increases, Q2 draws more current, reducing the feedback, and so the amplitude of the oscillator output.

To use a single power supply source, make up a voltage divider with a centre-tap to provide an artificial ground. Connect the base of Q3 to this ground through D1 and D2.

(From "Radio-Electronics".)

An add-in crystal filter

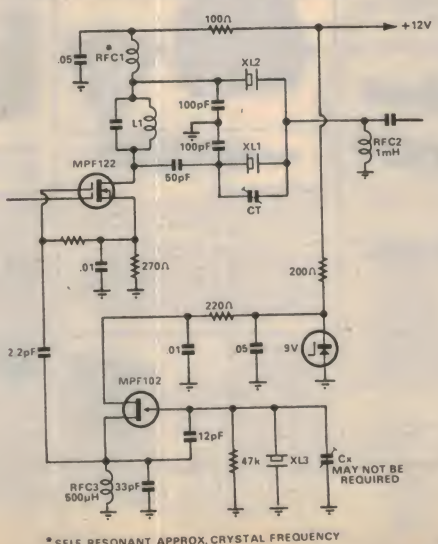
This crystal filter was built for considerably less than a commercial unit, and while it may not be up to some commercial standards it is more than adequate for good SSB and AM reception. I used crystals on a frequency of 6.5MHz but crystal frequency is not important except that a frequency should be chosen that does not clash with any frequency to be received. The crystals XL1 and XL2 should be about 1.5kHz apart and XL3 should be 455kHz (or the first IF) from the centre of XL1 and XL2. RFC1 should be self resonant at approximately the filter frequency.

The circuit has a gain of about 2dB and it can be added to an existing receiver with little modification. The output of the filter can go straight to the detector if necessary. The filter must be enclosed in a metal box and the positive supply rail must be well filtered.

When completed, L1 is aligned at the centre frequency of XL1 and XL2. This reduces the double hump and flattens the top of the response curve. Ct is a small capacitor of about 1 or 2pF, a "gimmick" or pair of insulated wires twisted together for about 2 to 3cm should be enough. This capacitor assists in steepening the sides of the response curve, but if too large it will cause side lobes to appear. The capacitor must be across the higher frequency crystal as it will widen the response curve if it is connected across the lower frequency crystal.

The filter which I have made has a bandwidth of 2kHz at 6dB down and 9kHz at 60dB down. This type of filter may also be used immediately following the mixer in a single conversion receiver with a tunable oscillator.

(By I. H. B., Everard Park, SA.)



*SELF RESONANT APPROX. CRYSTAL FREQUENCY

Dick Smith Ele

With inflation increasing prices at staggering rates we have concentrated this month on lines that are outstanding value. Where possible we are offering LOWER prices than normal by buying large quantities and passing on to you pre-devaluation prices. Please remember that we won't be able to keep these prices down. So take advantage of all the specials NOW.

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Jayem 100K a high sensitivity instrument boasting 51 ranges and having an extra large 5" movement.

Vdc: 0.3, 0.6, 1.2, 1.5, 3, 6, 12, 30, 60, 120, 300, 600, 1200. Vac: 1.5, 3, 6, 12, 30, 60, 150, 300, 600, 1200. Idc: 15uA, 30uA, 3, 6, 30, 60, 150, 300mA, 6A, 12A. R: 2k, 200k, 2M, 20M.

DB scale. Outputs. 3% accuracy 100k/V dc sensitivity. This is a tremendous meter which we are reducing while existing stock lasts by $6.00. Yes save $6.00, the normal price of the 100k is $41.00 but you need only pay $35.00 (P & P $2.00).

KE117 2 station is a highly attiicient solid state intercom capable of working over distances to 500 ft. Wall or desk mounting. Master has volume control. Supplied with 50 ft. cable. Normally $13.50. 100 only reduced till Christmas to only $10.50. Save $3.00.

100 only

Ask for a copy of our new catalogue. Sent FREE with your order if requested — or send 30c to cover P & P.

TREMENDOUS LOW PRICE WALKIE TALKIE OFFER CONTACT CT10

Remember the famous Midland 13700 units in our last year's catalogue? We sold thousands of these units (and no wonder when you read the spec). The Midland is no longer available but we have located an absolutely IDENTICAL Unit. ONLY THE NAME HAS CHANGED. Check these features:

Provision for 2 channels (27.240MHz or 27.880 MHz). Tuned RF stage. One microvolt sensitivity. Mute control. Calling tone. Heavy duty aerial. Maximum power allowable. PMG APPROVED (licence required). Transmitter effectively converts its 1W output power into a high ratio output power by high level push-pull class B modulation. Rugged case. Supplied with one set of crystals (specify frequency). Other frequency available at $4.50 a pair.

Range:	up to 10 miles depending on terrain up to 50 miles over water
Frequency:	27.240 or 27.880 MHz
Freq. Stab:	0.005%
Tx:	Crystal controlled 1W
Rx:	Crystal locked superhet
Antenna:	13 section telescopic
Power:	8 x 1.5V UM3 cells
Size:	8¼ x 3¼ x 1¾"
Weight:	25 oz

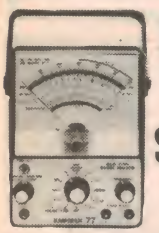
$39.95

We have the Contact CT10 at the same, YES SAME price as our old catalogue. It must be the cheapest, 1 Watt, fully approved unit in Australia at ONLY $39.95. Buy 5 or more and save $2.00 on each unit at only $37.95 (P & P $2.00 per unit).

Powerline 72 Engraver Kit engraves glass, metal, ceramics, embosses leather, carves wood, makes stencils. You can do so many things with this terrific double insulated two speed tool. Nylon body is well balanced for easy working and has a large control to adjust stroke length. Supplied with 13 precision accessories — saw chisels, knives, chuck, ball points, engravers, abrasives etc. Literally 100s of uses $29.95 (P & P $1.50).

CAR ENTHUSIASTS SPECIAL

We have a trial shipment of the fantastic Kamoden 77 Engine Analysers. This incredible instrument can be used to check state of batteries, generators, alternators, regulators, starters, distributor, ignition circuit and wiring. In addition to its electrical functions it can also be used as a tacho for tuning purposes and to accurately determine dwell angle of distributor. Suits any 4, 6 or 8 cylinder engine. Measures RPM on 2 scales to 1200 and 6000 rpm. Voltage from 0 to 3, 15 and 30V. Ohms to 100K. Checks diodes. Dwell angle to 90° in 4 cylinder engines. Current to 90A, yes 90A using shunt provided. Tests spark quality. Condenser substitution tool! Supplied with detailed 32 page manual describing all tests and giving circuit diagrams etc. 5 transistor circuit, large 4" meter for clearest readings. Complete with batteries (1.5V and 9V). This instrument could pay for itself the first time you use it and save costly garage bills. Hurry though, we are only bringing 30 in at this price $49.00 (P & P $2.00



30 only at $49.00

1.5V RADIOS Remember those little radios we had earlier this year that run off a 1.5V cell. They're back again. Yes a proper little 6 transistor superhet in tough fit-your-print case. Earpiece included. Many were sold for the parts despite the fact that they do work. Save a fortune in batteries. Only $5.95. (P & P 75c).

$5.95

630 Battery Saver is a fully approved, double insulated job for extra safety. Will supply up to 300mA and is suitable for 6V, 7.5V or 9V appliances. Save a fortune on batteries with this neat little unit. Ready to plug in for just $10.90 (P & P 75c).

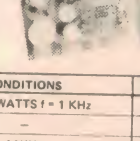
Just in SONY TRINITRON COLOUR TV's selling at only $550. Why pay $850 when Dick has these great Sony TV's at only $550. Rush your order now!

SAVE on 8-30's

MAGNAVOX 8-30 speakers 30 Watt woofer featured in our catalogue. Forms the basis of a great speaker system. Cabinet details in our catalogue. 8 ohm. Normal price is $18.50, we have a bulk purchase which saves you over $3.00. Buy now for just $15.00 or a pair for only $29.00.

AM/FM MULTIPLEX TUNER There is a shortage of tuners so get your's early. On Separate AM and FM front ends. 10 transistors, 14 diodes. FM 88 to 108MHz, AFC, 60 dB S/N, 35 dB sep, 600 mV output AM 535 to 1605kHz, ferrite rod. Multiplex adaptor built-in with indicator. 240V operated in Walnut case. Guaranteed 12 months. Only $75 (P & P Free). Hurry, demand is going to be heavy.

LOW COST AUDIO AMP MODULES
Fully wired, tested and guaranteed.



From $9.90

The AL10, AL20 and AL30 units are similar in their appearance and in their general specification. However, careful selection of the plastic power device has resulted in a range of output powers from 3 to 10 watts R.M.S.

The versatility of their design makes them ideal for use in record players, tape recorders, stereo amplifiers, and cassette and cartridge tape players in the car and at home.

PARAMETER	CONDITIONS	PERFORMANCE
HARMONIC DISTORTION	Po = 3 WATTS f = 1 KHz	0.25%
LOAD IMPEDANCE	–	8-16 ohm
INPUT IMPEDANCE	f 1KHz	100 kohm
FREQUENCY RESPONSE ±3dB	Po = 2 WATTS	50Hz–25KHz
SENSITIVITY for RATED O/P	V8 = 25V. R18 f = 1KHz	75mV. R.M.S.
DIMENSIONS	–	3" X 2½" X 1"

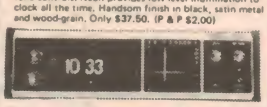
The above table relates to the AL10, AL20 and AL30 modules.

The following table outlines the differences in their working conditions.

PARAMETER	AL10	AL20	AL30
Maximum Supply Voltage	25	30	30
Power output for 2% T.H.D. (RL = 8ohm f = 1KHz)	3 watts R.M.S. Min.	5 watts R.M.S. Min	10 watts R.M.S. Min.
NORMAL PRICE OUR PRICE	$13.00 $9.90	$15.00 $10.90	$16.00 $11.90

CAR RADIOS We boast the fact that we have a radio to suit every car. Call in and prove us wrong!! While you're here see the fabulous new AWA PU950 combination Cassette player has tunes fast forward and rewind plus autoreverse, while the radio has a search tune facility. Until Christmas we will supply the 950 for $199 with speakers and aerial (P & P $2.00).

Digital Clock Radio ideal gift featuring mains operated digital clock which will switch on the 6 transistor radio at any time you like and switch off at up to 60 minutes after setting the 'sleep' switch. Radio has universal crossed pointer dial, volume and tone controls. Neon provides low-level illumination to clock all the time. Handsom finish in black, satin metal and wood-grain. Only $37.50. (P & P $2.00)



Now FM/AM only $49

CONDENSER MICS
Dual impedance electret microphones provide the response that only condenser mics can from a low 20Hz to 18kHz. Unsurpassed tonal quality across the whole audio spectrum. Powered by a single 1.5V cell located inside which runs for up to 1000 hrs. Very slim only 0.88" diameter. Dual impedance 600 ohm or 50k. On-off switch. Built-in FET low noise pre-amp. Supplied complete with wind shield and microphone holder for use on stand. 20 ft. of cable with jack.

Sensitivity –48dB on 50k, –62dB on 600 ohm Sig/noise 50dB at 1kHz. Max sound pressure 130dB. Omni-directional type ECM1005 $22.50 Cardiod type ECM1015 $28.00. (P & P $1.00)

HUSKY CHARGER Automatically charges 12V batteries at up to 4A. Flat to fully charged overnight. Full wave circuit, double insulated for safety with foolproof fusing. Approved by Electricity Authority. Housed in attractive, unbreakable case measuring 3¾ x 3¾ x 5¾" and weighing 3.8 lb. Neon indicator. Fully guaranteed $23.00 (P & P $1.75).

Lenk Cordless Iron
The BP100 is the greatest development yet. Runs off a rechargeable cell giving up to 120 joints per charge. Press the button for soldering heat in only 5 seconds *plus built-in* working light.

Ideal for use on cars, caravans, boats etc. Anywhere you can't trail mains leads. Serviceman's dream. Ideal for CMOS and delicate IC circuits since there are no earth leakage currents. Only for electronic soldering (won't mend kettles!). Iron complete with tip at only $19.95. Mains charger BP100AC only $10 or build a 6V or 12V car charger for only 50 cents (P & P $1.00) 90 day guarantee. Spares available.

Reference Data for Radio Engineers
(1196 pages). This messive book contains everything you need to know. Over 1½ million copies sold all over the world. Contributions from 100 leaders-in-their-fields, engineers, professors, government experts and staff of ITT. 45 chapters, 100s of charts, nomographs, diagrams, curves, tables, pictures. Yes there's 1196 pages full of everything. We have a large quantity of the latest edition still at $24.00. Until Christmas we will mail this book post FREE. Postage is normally over $2.00 because it's so heavy!

EDUCATIONAL KITS

Experimenters kits have always been popular with beginners. They make ideal Christmas presents for young and old alike. This year we have the new Denshi Block kits which use plug in type modules as well as the Science Fair wire link type kits. All are highly recommended and some are used in schools. Circuits can be used over and over again. All are completely safe operating from low voltage batteries (extra). Get a kit and a basic book and you're on your way to becoming another boffin!

CRYSTAL RADIO KIT. This easy to build radio uses the same circuitry developed by Marconi for the first radio transmissions . . . an ideal introduction to basic radio theory for tomorrow's engineers. It will receive all local radio stations, no battery is required and it takes only an hour to build. Dimensions 1" x 8" x 1½". $3.95 (P & P 30c).

NEW DENSHI MODULES

Denshi ST45 features a build-it-yourself radio. The circuit board has been built into a transistor radio case with a ready built amplifier module complete with loud-speaker. The module has a 3 transistor push-pull amplifier with volume control and 9 V battery. 22 modules are included which will make 45 circuits ranging from radio circuits, morse code trainers, bird simulator, metronome, even a spy radio bug! Components include transistors, diodes, transformer, morse key, mic, earpiece etc. 80 page manual and neat radio case all for $16.50.

Denshi SR3A. The giant kit with 195 experiments, reflex radios, record player amplifier, wireless mic, burglar alarm, photoelectric warning device etc. This one has a 3 stage circuit board and special control panel with speaker switch, volume control etc. Has separate extension speaker for intercom etc. Solar cell included plus 46 modules morse key, earpiece, mic etc. Supplied with descriptive manual and excellent value at $24.40.

MICRO COAX

Miniature Coax
Less than 0.1" diametar high quality coax for wiring miniature transmitters etc. etc. Handles power to 120W, 50ohm impedance 27pF per foot. Only 25c/ft.

GRAB THESE

R.F. POWER TRANSISTOR SPECIAL
Huge pre-devaluation purchase of R.F. power transistors from Solid State Scientific enables us to REDUCE prices on these devices. Fully guaranteed, premium quality devices at savings up to $2.00 each.

2N5589 7W was $6.50 NOW $4.90
2N5590 15W was $7.75 NOW $6.90
2N5591 30W was $9.85 NOW $7.50

Set of 3 to give complete chain (see Kits!) was $22.50 NOW $19.25.

Get together with your friends (or club) bulk purchase and share the savings.

BOOKS

New PAL Book

At last an Australian PAL book
PAL Colour TV for Servicemen by Cook, Wren 248 p $15.00. This is a must. Written by an Aussie, this is the best book on Aussie PAL (and N.Z. too). Assumes B & W experience and covers theory in a not too technical way. Practical approach to solid state and IC circuits. Very thorough with heaps of diagrams, many in colour. Well written by a man with 30 years experience who set up training courses here.

Projects and Circuits from Electronics Australia $2.00. It's a beauty, all the popular tried and tested circuits from EA: Reaction timer, tape amp, songos, microradio, train controller, tuner, novelties etc. etc. There's over 30 projects and 112 pages for only $2.00.

ELECTRONICS CIRCUITS MANUAL, Markus, 590 pages.
A phenomenal book in 99 chapters gives 3,100 circuits with values of all parts for every imaginable application. Think of any application and you'll find a circuit to kick your design off. Every lab should have one for browsing. Each circuit has full design reference so the book acts as an index to save time searching in other publications. Large format and the best value. $22.00. (P & P $1.50)

US RADIO AMATEUR CALLBOOK lists 263,000 K and W calls in over 600 pages. Covers all States and US citizens overseas $9.95 (P & P 75c).

FOREIGN RADIO AMATEUR CALLBOOK is the companion volume listing over 211,000 amateurs outside U.S.A. Also has a useful selection of info. Over 400 pages give full address information. $9.95 (P & P 75c).

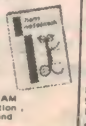
BOTH CALLBOOKS FOR ONLY $16.00

RADIO AMATEURS PREFIX MAP OF THE WORLD makes any shack look respectable. Printed in 4 colours showing 40 DX zones, prefixes etc. Mercator projection 40" x 28" on heavy folded stock. At only $1.50 (P & P 30c) you just have to get one eh?

WORLD ATLAS is the only one produced specially for the Amateur. 20 pages give 11 beaut maps in 4 colours by Lambath projection, ideal for field trips or the bookshelf. $3.00.

DON'T FORGET
HAM NOTEBOOK
A continual best seller, HAM NOTE-BOOK in its 14th short months has well established itself as an important part of any amateur's library.

This book is taken from the best of HAM RADIO's popular Ham Notebook section and has a wide variety of short ideas and projects on virtually every phase of amatuar radio. $4.50.



Huge Savings on Special D.S.E. "EICO" Transformers
Manufactured for Dick Smith Electronics. Full satisfaction guaranteed.

DSE 2851	240V AC at 12.6V at .15A centre tapped	$3.50
Normally $6.50	Special $3.50 P&P 50c	
DSE 2155	240V AC to 6.3, 7.5, 8.5, 9.5, 12.6, 15V at 1 amp — an ideal multi purpose power transformer.	$4.75
Normally $6.50	Special $4.75 P&P 50c	
DSE 6672	240V AC to 30, 27.5, 24, 20, 17.5, 15 or 30V C.T. at 1 amp.	$6.50
Normally $11.00	Special $6.50 P&P $1	
DSE GIL-2	240V AC to 18 volts at 6 amps. Designed for 13.8 volts DC power supplies and battery chargers — new "C" core type. $14.50 P & P $1.	

DICK SMITH "EICO" POWER SUPPLY KITS
Almost every project you build needs a 240V ac power supply, so we've put together some bargain kits. They all include full circuits, instructions, transformer, filter capacitors and all semi-conductors, Metalwork etc. not included.

PS2VA has a 240/12V ct at 150mA transformer and gives 9 or 19V on open circuit. Typical outputs are 6V @ 300mA and 12.6 to 13.6V @ 150mA. Ideal for battery saver or NiCad charger etc., running 9V radios and recorders etc. $4.95.

PS15VA uses the PF2155 multitap transformer to give a wide selection of outputs, e.g. 2 to 22V at no load, 4 to 16V @ 1A, 8.3V @ 1½A and many more $7.25. (P & P 75c).

PS121 Reg gives 12V @ 1A, fully regulated and protected by the popular Fairchild 7812 IC. Ideal for projects requiring protection with good regulation and filtering. $10.25. (P & P $1.00).

PS5 Reg As the PS121 Reg but gives 5V dc @ 1A for TTL logic projects etc. $10.25 (P & P $1.00).

PS122 Reg is a completely adjustable, regulated supply for 9 to 12.6V dc @ 2A and uses a 2N3055 regulator transistor. Ideal for running car stereos in the home $19.75 (P & P $1.50).

PS125 Reg is fully regulated to give under 2mV ripple at full load. Adjustable from 9 to 13.8V dc @ up to 5A. Ideal for bench supply and operating transistorised 2-way radios, etc. Uses 'C' core trenny. 7231C and 2N3055s. Ideal for Amateurs to run mobiles from mains. $27.50 (P & P $2.50).

DICK SMITH WHOLESALE PTY LTD

Head Office and Mail Orders to 160-162 Pacific Highway, Gore Hill NSW 2065 Telephone 439 5311
Also at 361 Hume Highway, Bankstown (100yds from Chapel Road)
Tel 709 6600 P&P 50c unless otherwise stated.

ctronics Centre

Have A Happy Kitmas

No. 11 Playmaster 143 Hi Fi Amp E.A. September, 1974
This unit is an improved version of the Playmaster 136 of which over 10,000 have been made. 12½ Watts per channel into 8 ohm at a typical 0.4% THD and within ±2dB from 20HZ to 20KHZ. Inputs are 2mV into 50K and 150mV into 500K. Noise figures 60dB down with all input open and 44dB X talk. An excellent unit which has been designed so that conversion to 4 channel can be made with a minimum of fuss. Ideal for the home environment and has provision for headphones.

No. 2 100W Guitar Amp ET1 413 December 1972
This is THE Guitar Amplifier. A full 100W RMS at 0.5% distortion from 50HZ to 20KHZ with a 4 ohm load. Connect as many speakers as you like as long as the combined impedance is more than 4 ohms. Input impedance 3.9 Kohm. Extremely rugged construction. **$75.00** (P & P $2.00).

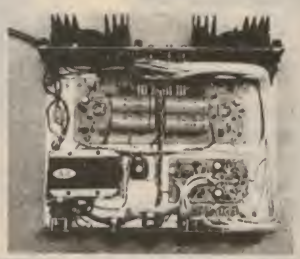
No. 2A 100W Guitar Preamp ET1 419 September, 1973
Designed to match the ET1 413. Has two inputs, 2mV at 1K and 20mV at 47K. More can be added if you wish as the unit has mixing facilities and can be either built into the 100W Amp or used separately. Kit is complete with bass and treble controls. **$13.50** (P & P 75c).

No. 71 ET1 422 Stereo Amp Complete

★ **SPECIAL NOTE**
Beware of cheaper prices. Our kit includes rear panel genuine METAL TO3 Pack 115W output transistors exactly to spec. No cheaper lower, power plastic types (special kit with cheaper plastic types for $115 not recommended)

SPECIFICATIONS
Power output 50Wrms Frequency Response 35dB from 20Hz to 20kHz. Channell separation 45dB. Hum & Noise – 78dB (aux) – 67dB (disc) Input sens. Aux 210mV Disc 2.1mV, Main amp 500mV. Distortion (10W) 0.16% Tone controls ±13dB. Damping factor >70. PCBs in fibreglass throughout. Handsome teak cabinet. Full instructions.

This stereo amplifier kit is complete in all details and conforms with the E.T. design of May 1974. A guaranteed 50W RMS per channel into 8 ohm loads, from 20HZ to 20KHZ at 0.5 dB. Distortion less than 1%, typically 0.15%, many facilities including tape, tuner mike inputs, preamp output, main amp input at 3 basic sensitivities of 2.1mV, 210mV and 500mV. Kit comes complete in every way. Definitely the best build-it-yourself amplifier available and equal to many commercial units costing three times as much. **$135.00** (P & P $3.00).



No. 9 Capacitor Discharge Ignition E.A. August, 1970
Get the best out of your car's engine. Fit this C.D.I. It will suit 12 volt systems, positive or negative earth. A well proven unit designed to give you the "mostest for the leastest". **$22.50** (P & P $1.00).

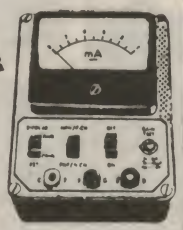
No. 69 ZN414 Receiver E.A. May 1974
The ZN414 is an I.C. which requires only two resistors, two capacitors, tuning gang and coil. 1.5 battery and earpiece to become a transistor radio. It can truly be built in a matchbox yet will give performance which will astound you. Can you afford not to build one! Includes all electronic parts and free circuits. **$6.75.**

No. 105 1.5 Watt Amplifier ET1 225 E.T. May 1974
A small amplifier is virtually indispensable to the experimenter. Can be used as an amplifier, signal tracer, monitor etc. Its uses are innumerable. It is very easy to build, is not very particular as to layout and extremely low priced. Runs off 12 volt D.C. **$4.90.**

No. 106 Temperature Meter ET1 226 E.T. May 1974
An extremely simple "press to read type" temperature monitor. Ideal for use with a number of sensors in different localities e.g. pools, outside temperature, inside temperature etc. Range is from 0°C to 100°C. Runs off 9 volts. **$10.75** (P & P 75c).

HUGE PRICE BREAKTHROUGH
Because of direct importing of expensive components like the transformer we can reduce the price of the Playmaster 143 by nearly $10.00.
Now only $69.90 plus $3.00 P & P every top quality part supplied inc. magnificent metal front panel (fully silk screened). Yes — why pay $75.00 when we charge only $69.90.
Limited offer for the first 250 kits only.

★ **EA EDUC 8 COMPUTER PCB SET $32.50**



$18

No. 14 Transistor Tester E.A. August 1971
A very simple project which will enable you to test any of your transistors including FETS. Uses only a handful of parts but the performance is better than many commercial units. It is so easy to build and operate that no serious electronic hobbyist should be without one. Ideal for use by schools also. Runs off its own 9 volt battery. **$18.00** (P & P 75c).

No. 104 Temperature Alarm ET1 244 E.T. May, 1974
Indispensable for those with greenhouses, glass houses, tropical fish or chicken incubators. Will give a loud clearly audible warning when the temperature either falls below or rises above a pre-set temperature. Will operate over temperature range of –20°C to +150°C. Needs a 6 volt battery. **$7.90** (P & P 75c).

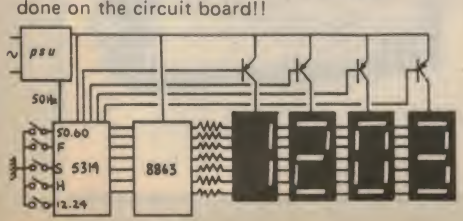
Dick breaks the TIME~PRICE barrier!

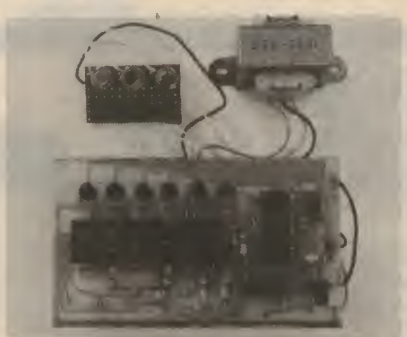
A DIGITAL ELECTRONIC CLOCK KIT $29.95

No, not the usual $59.00 but a complete kit for only $29.95 using top quality National semiconductors. Even the basic beginner can build one in under an hour following our simple instructions. Full money-back guarantee so why not buy one, inspect it at home for 7 days and if not satisfied return the kit and we will refund your money.

Check these terrific features:
- *Operates on 240V mains 50 or 60 cycle*
- *12 or 24 hour display*
- *Large 0.3" Red LED solid state display*
- *Full circuit board supplied*
- *Easy to understand instructions*
- *'Seconds' readout can be easily added*
- *Power supply included — no extras*
- *Uses brand new National ICs and semiconductors. Spares are available.*

Here is the actual circuit. One of our staff members built his in only 40 minutes. Remember most of the wiring is already done on the circuit board!!





As featured in E.T.I. with Seconds option

Kit includes the following:
2 ICs, 4 readouts, 4 driver transistors, PC board, transformer, pushbuttons, resistors, diodes, capacitors, etc. NOTHING MISSING except a case which you can easily make yourself or use one of our zippy boxes.

Special Seconds Readout requires only two transistors, two readouts to make a full 6 digit clock. No extra wiring since circuit board has provision for expansion. Special price for seconds kit is only **$6.00.**

Short form kit for the budget conscious contains all semi's and instructions you simply add common components and use veroboard or etch your own PCB. We've cut this one to the bone at **$19.95.** Still can't believe it's this cheap? Well send a stamped self addressed envelope and we'll send you the instructions.

Please use this coupon to speed delivery

Dick please rush me your
Digital Clock kit @ **$29.95** ☐ Allow
Seconds Readout @ **$6.00** ☐ 75c
Short form kit @ **$19.95** ☐
Zippy box case @ **$1.80** ☐ P & P
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Name: .....
Address: .....
.....Postcode: .....

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Dick Smith Electronics Centre

V.H.F. All-Band Communicator RADIO SENSATION

★ *Complete VHF coverage*

★ *Separate front-end tuners*

★ *16 transistors, 15 diodes, 2 rectifiers, 1 varistor*

For the first time, Dick Smith is proud to introduce a VHF receiver that covers all bands. Yes even the much sought after low band from 60 to 85 MHz. This exciting new monitor receiver covers Broadcast band plus 50 to 220 MHz in 4 bands.

Warning Do not confuse with similar looking receivers with only limited coverage.

We are introducing the Communicator 33, including built-in 240 V ac adaptor and earpiece delivered anywhere in Australia with FREE insurance for only $59.00. You only have to plug it in or use batteries supplied, then open up these fascinating bands!

CHECK THESE UNBELIEVABLE FEATURES:

- *Separate tuner front ends eliminate all the complex problems of switching r.f. circuits and design compromises.*
- *Exclusive Red-Led signal strength indicator. Light emitting diode glows on tuning pointer as signal is tuned in. Also acts as signal indicator when volume is turned down. Brightness indicates strength almost as critically as meter movement and is much more reliable.*
- *Full AFC can be switched on or off. This automatic frequency control overcomes drift on VHF signals.*
- *240V ac or battery operation. Just flick the switch for mains or battery operation.*
- *Handsome 'Military Look' Finish in black with white lettering etc. and grey functional controls. Positive grip and action on tuning control. Vinyl carrying case complete with shoulder strap.*
- *Multisection telescopic aerial adjusts for horizontally or vertically polarized signals.*
- *Tone control adjusts Bass and Treble response to reduce noise.*
- *Earphone socket built in*
- *Large band change switch*

This receiver is ideal for the location of bugging devices which mainly operate in the VHF bands. Simply tune receiver for feedback signal.

SPECIAL PRICE $59

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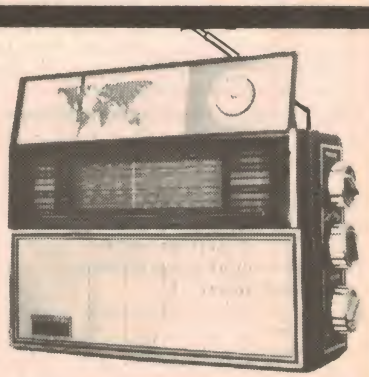

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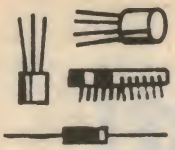


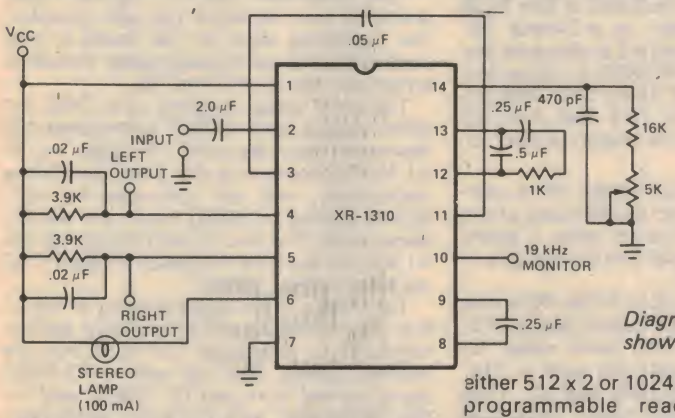
What's new in Solid State

FM stereo decoders using one IC

With experimental FM transmissions due to begin some time this month in Sydney and Melbourne, it is nice to be able to note the release of two new "everything on the one chip" FM stereo decoder devices, either of which should make it very easy to add stereo decoding to existing mono receivers or tuners.

One device is the XR-1310, from Exar Integrated Systems, and the other is the LM1800 from National Semiconductor. Both are being promoted as "second generation" phase-locked loop demodulators, to distinguish them from earlier devices.

In each case the device is designed to take the composite signal from the normal FM demodulator, and perform all of the remaining operations necessary to produce the final left and right channel audio outputs. They contain not only the circuitry to regenerate the 38kHz subcarrier and decode the two stereo channels, but also circuitry to automatically switch from mono to stereo and operate a 100mA stereo indicator lamp.



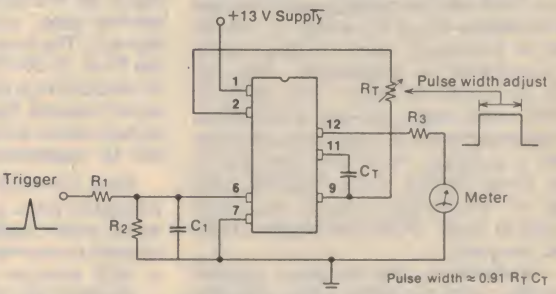


Diagram at left shows how XR-1310 FM stereo decoder is used. Above shows SW781 device used as an auto tachometer.

But perhaps the best news of all is that only a handful of minor parts are needed to go around them. And there are no coils at all, as you can see from the diagram for the Exar device. The VCO in the phase-locked loop is tuned by means of a pot, being an R-C oscillator. This means that alignment is very straightforward.

The Exar device will work from any supply rail from 8 to 14V, while the NS device is even more tolerant — 10 to 24V. Both offer a channel separation of typically around 40-45 dB. Both devices are expected to be less than $10 in one-off quantities.

Agents for Exar in Australia are A. J. Ferguson Pty Ltd, whose office in NSW is at 29 Devlin Street, Ryde. The agents for National Semiconductor are NS Electronics, at the corner of Stud Rd and Mountain Hwy, Bayswater, Victoria, or at 2-4 William St, Brookvale NSW.

Another interesting device which is also handled by A. J. Ferguson is designated a "tachometer driver". Made by Stewart-Warner Micro-circuits, it is a monostable multivibrator which has almost all of the circuitry needed to drive a meter movement as an auto tachometer.

The basic circuit required to use the SW781 as a tachometer is shown in the second diagram. For triggering from across the breaker points in a conventional negative ground 12V system, recommended values for R1 and R2 are 9.1k and 1k respectively, with C1 being .004uF or less. It is also possible to trigger the device from the pulse appearing across a ballast resistor, if used. Resistor R3 should be about the same resistance as the movement, or larger. Timing resister Rt should be 4k or more.

Another new IC which should be of interest is an LSI digital memory device which the makers, Nitron Corporation, describe as an "electrically alterable non-volatile memory". Designated the NC7010, the device has 1024 bits of storage (organised either 512 x 2 or 1024 x 1), and is basically a programmable read-only memory or "PROM" which can be re-programmed repeatedly by the application of suitable write signals.

Essentially, the device is something of a cross between a read-write RAM memory and a PROM. Its storage is non-volatile, meaning that stored data is not lost when the power is turned off. The NC7010 can store data for years if necessary without power, so that in that respect it is like a ROM or PROM. Yet it can be erased and stored with new data, and is therefore also like a RAM.

There have been other devices capable of doing this, but to date they have required ultraviolet radiation to erase one program before a new one can be written in. The NC7010 is different in that it is erased simply by means of electrical signals. The erasure and writing can also be done selectively, in blocks of 128 bits.

The NC7010 uses metal nitride-silicon dioxide gate MOS transistors as the elements in its memory array, and the data is stored by shifting the conduction thresholds of the transistors between two stable values. This is done by trapping charges in deep energy traps in the gate insulation, by means of a writing pulse.

The NC7010 may be interfaced with either TTL or CMOS logic without difficulty. Erasing takes about 2 seconds, while writing takes from 1 to 1.5 milliseconds. Total read access time is typically 20us.

A possible application for the NC7010 might be in amateur radio repeaters, for storing the identification message. It would also be suitable for storing CQ calls, for ardent morse enthusiasts.

Local agents for Nitron Corporation are Ampec Engineering Co, of P.O. Box 18, Strathfield, NSW.

On more mundane lines, Signetics Corporation and Texas Instruments in the US have just announced mass production of a new TTL logic device family, which they are calling the "54/74LS" series.

Until now, we have had normal or 54/74 TTL, which is fairly fast but draws reasonably high current. Then the makers came out with low power or 54/74L TTL, which offered lower power consumption but also significantly lower speed. Then the range was expanded with a third family, 54/74H, which is faster but even more power hungry than the original family.

But even 54/74H could not compete fully with the speed of emitter-coupled logic (ECL), so they looked around for a better answer. This proved to be the addition of hot-carrier or Schottky diodes, which speeded up operation without drastically increasing the current. So a fourth family was born: 54/74S.

The trouble is that equipment makers have now become more critical of the speed/power ratio offered by the original 54/74 family. Although faster than CMOS, its power consumption is much higher.

What Signetics and TI have done is come up with a new "middle of the road" TTL family, by taking the low power 54/74L designs and speeding them up with Schottky. This gives the best of both worlds — low power with high speed. So we welcome a fifth family: 54/74LS.

The new 54/74LS devices have the best speed to power ratio yet achieved for high speed logic, and are 5 times better than the original 54/74 family.

Apparently the new devices are being snapped up by makers of computer terminals and similar equipment, where the demand is for smaller and smaller size, cooler operation yet faster speed. Whereas updating designs to CMOS needs power supply changes and often logic changes, a change to 54/74LS is simply a matter of dropping in the new devices. (J.R.)

For further data on devices mentioned above, write on company letterhead to the agents quoted. But devices should be obtained or ordered through your usual parts stockist.

The EDUC-8 computer: getting it going — at last!

Continuing with the construction of our unique digital computer project, the author describes here the program counter and adder section, and also the memory section. This completes the basic machine, which should now be capable of running in a limited way via the console controls and indicators.

by JAMIESON ROWE

Having completed the assembly and testing of the timing and run control, decoder, and accumulator sections, you should now be in a position to complete the basic machine by adding the program counter and adder section, and the vital memory section. These will be described here, together with details of how to check operation as you progress.

If you are keeping up with the description, all going well you will have by the end of this stage a complete basic computer, capable of storing a program and executing it. The only thing is that it will be an "introvert", capable of communicating with the outside world (i.e., you!) only via the console switches and LED indicators. So that while it will be capable of running, it won't perhaps seem very spectacular or impressive. This will have to wait until we give it the ability to deal with input-output devices, and provide it with some of these to communicate with.

These preliminary comments are just to let you know where we're heading, and perhaps to encourage you if you were beginning to falter. With that done, I hope we can proceed.

For convenience, the program counter (PC) register and the serial adder circuitry are grouped together on a single plug-in board, coded E8/P. This board is the same size as the other plug-in boards described, 21.5 x 16cm, and has connector pads to mate with both a 32-way and a 16-way edge connector socket. It plugs into the sockets fourth from the top on the mother board, immediately above the accumulator board.

The logic for the program counter and adder sections is shown in Fig. 1. As you will perhaps have already noticed, the PC register itself is formed by two 7496 five-bit shift register devices, with only three flip-flops being used in the first device. This gives a total of eight bits, so that the PC is capable of handling the 8-bit address words needed for 256 memory locations.

The five parallel inputs of the 7496 which is fully used are connected to pads 24-28 inclusive of the board edge connector, and thence to SR0-SR4 of the switch register. Similarly the three active parallel inputs of the second 7496 are taken to SR5, SR6 and SR7, in this case via flying leads (this device has been added to the original design, as part of the memory expansion to 256 words, and this is the reason for the flying leads).

The connections between the eight parallel inputs and the switch register are for loading addresses into the PC.

The actual load address operation is carried out by means of the LA1 (L) and LA2 control signals, which you may remember are generated on the front panel board by logic connected to the "load address" key. These signals arrive at the PC board via pads 17 and 18. The LA1 (L) signal is connected to the clear inputs of the 7496s, to clear them of any previous content. The LA2 signal line connects to the parallel load enable inputs (PL), and this signal thus causes the new address to be loaded from the SR after clearing.

The least significant bit (LSB) output of the PC is connected to the C-bus output line, pad 6, via a control gate. The control signal for this gate is produced in turn by a second gate, connected as a 2-input OR element. The two signals fed to this gate are the T2-9. (F OR DEP OR EXM) (L) signal fed to the board via pad 20, and a T2-9.JMS (L) signal derived from the T2-9 and JMS (L) signals which arrive at the board via pads 13 and D, respectively.

Thus the LSB output of the PC is connected to the C-bus and the B2 input of the serial adder during T2-9 of either a fetch, deposit or examine cycle, and during T2-9 of a JMS execute cycle.

Similarly the LSB output of the PC is also connected to the B-bus output line, pad 5, and the A1 input of the serial adder, by means of a control gate fed with a T14-21.SKP signal derived from pad 22. Thus this pathway is enabled during T14-21 of the execute cycle of any of the instructions involving instruction skipping.

The serial input of the PC is permanently connected via an inverter element to the A-bus input, pad 4. The output of the serial adder is connected to the A-bus line via a control gate, whose control signal is produced by a 4-input gate functioning as an OR element. And among the signals fed to this element are the T2-9. (F OR DEP OR EXM) (L) signal, and indirectly via further gating the T14-21.SKP (L) signal. These signals also fed to other gates connected to the control inputs Ac and Bc of the serial adder, which will be described in more detail in a moment.

MCP pulses arriving at the board via pad 11 are fed to the clock pulse inputs of the 7496 devices via yet another control gate, whose control signal is again produced by a 3-input OR element. And not surprisingly, the signals which thus enable the clock pulse gate are T2-9. (F OR DEP OR EXM) (L), T2-9.JMS (L), and T14-21.SKP (L).

The net result of all this is that during T2-9 of a fetch, deposit, or examine cycle, or T14-21 of the examine cycle for a skip instruction, the contents of the PC are effectively shifted out of the register to the A-bus, through the adder, and back into the register again. Providing the carry FF of the adder is set to one before this operation, the PC content is therefore incremented at these times.

In addition, the content of the PC is also shifted out onto the C-bus during T2-9 of a JMS execute cycle, ready to be written into memory.

In tracing through these logic paths you probably also noticed that a path from the C-bus to the serial input of the PC, via the serial adder, is also enabled during T14-21 of either a JMS or JMP execute cycle. This is performed by the signal T14-21.(JMS OR JMP (L), which arrives at the board via pad 21. This signal also enables the clock pulse gate of the PC.

The purpose of this further logic is to allow the content of the PC to be replaced as required during a JMS or JMP execute cycle, from the MA register.

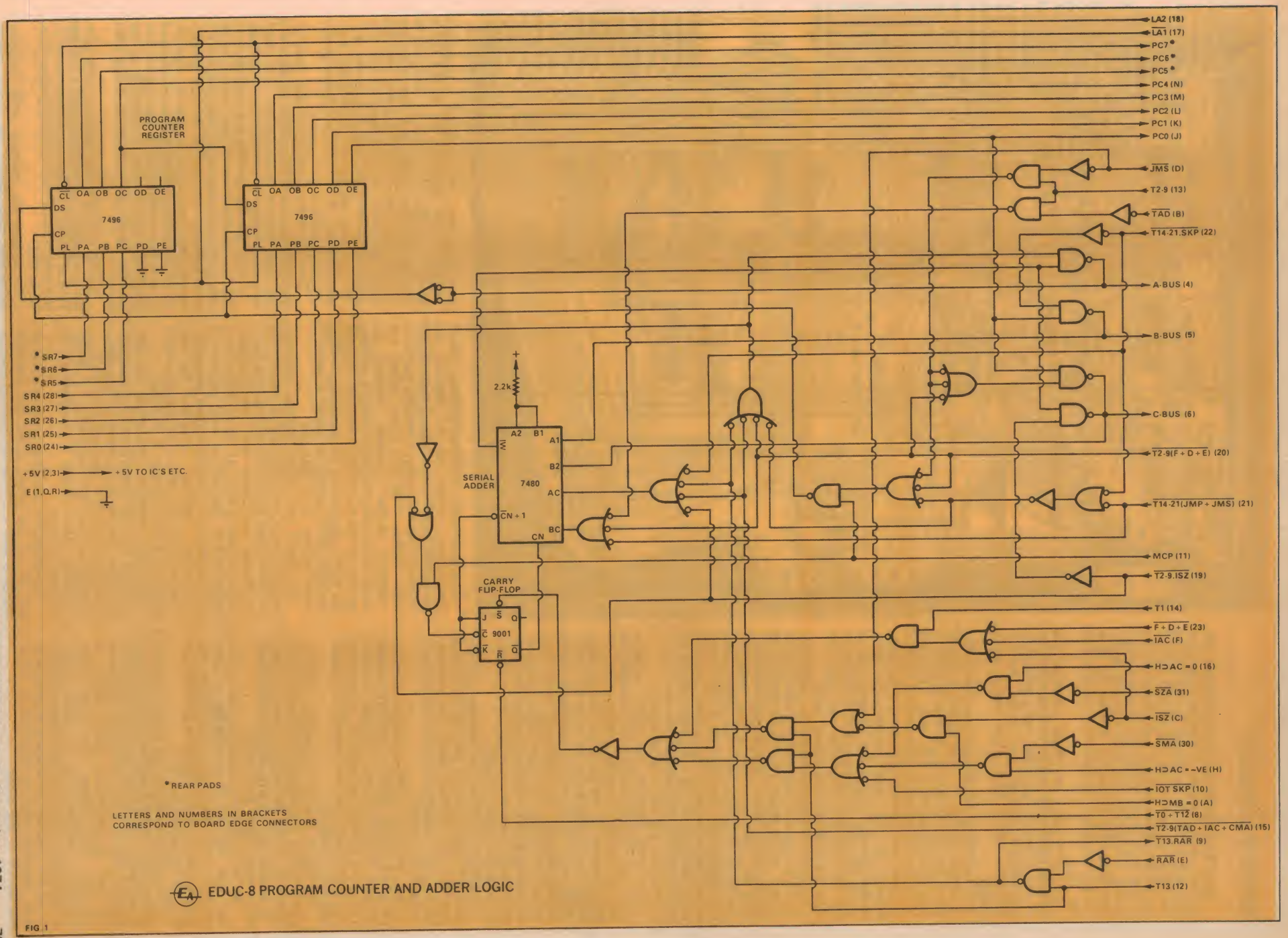
This completes the PC register logic, which as you can see is not very complex. The remaining logic on the board is that associated with those serial adder functions which do not involve the PC.

The serial adder consists of a 7480 full adder device, with a 9001 high-speed J-K flip-flop to store the carry. The adder inputs A1 and B2 connect to the B-bus and C-bus respectively, and are controlled by logic signals applied to gating inputs Ac and Bc respectively. The two unused inputs A2 and B1 are tied together and taken to the 5V rail via a protective resistor.

The output of the adder is taken to the A-bus via a control gate, as we have already noted. It is also taken to the C-bus via another control gate, fed with a T2-9.ISZ signal derived from pad 19. This is used for the "increment" part of the ISZ instruction.

The carry FF is reset at times T0 and T12 of every machine cycle by the (T0 OR T12) (L) signal applied to its R-bar input from pad 8. Where the adder is to be used for incrementing either the PC, the AC or a number fed from memory, the carry FF is then set to 1 at either of times T1 or T13, by means of the logic connected to its S-bar input. For brevity this will not be described in detail; but note, for example, that setting occurs at T1 for either fetch, deposit, examine, IAC or ISZ. The setting at T13 occurs for a variety of other signals and signal combinations, such as ISZ again, or SZA together with a clear accumulator.

When the adder is used for incrementing, the signal to be incremented is applied to either the A1 or B2 inputs, from the B-bus or C-bus, and appropriate control signals applied to the adder control inputs and the output control gates to enable the right paths. The same procedure occurs for true binary addition, which occurs only during T2-9 of the TAD execute cycle. In both cases MCP pulses are also fed to the clock input of carry FF, so that it correctly stores the individual bit carries.



EDUC-8 PROGRAM COUNTER AND ADDER LOGIC

FIG. 1

EDUC-8 computer

Apart from incrementing and addition, the adder is also used as a passive data path from the B-bus to the A-bus, during T2-9 of the CMA execute cycle, and at time T13 of the RAR execute cycle. It is similarly used as a data path from the C-bus to the A-bus, during T14-21 of the JMP execute cycle. The latter path is used to transfer the new "next instruction" address from the MA into the PC.

You may care to follow through the detailed logic paths involved in the operation of the adder for yourself, using the basic organisation diagram and cycle and instruction timing table given earlier as a guide.

The wiring of the program counter board is shown in Fig. 2. This board is coded E8/P, and like those plug-in boards already described measures 21.5 x 16cm. There are 14 ICs on the board, together with a handful of minor components and some wire links. Wiring up the board should be fairly straightforward using the diagram as a guide; the main points to watch are that the ICs are correctly orientated and that the links are between the correct pads.

Note that there are connection pads near the 7496 device whose axis is parallel to the "back" of the board, for the attachment of flying leads to switch register switches SR5, SR6 and SR7, and to the LED indicator circuits for PC5,PC6 and PC7. Flying leads are needed here because this is the device which I have added to expand the PC for the larger memory; it has not been possible to provide for the connections via the plug-in connectors and the mother board.

The flying leads to the switch register should be fairly self evident. Of those for the LED indicators, the leads marked PC5 and PC6 simply go to the points on the top edge of the front panel board which are marked (PC5) and (PC6) in the previously given wiring diagram. The remaining lead, that marked PC7, will be dealt with shortly; it requires special treatment because the front panel board has no provision for an eighth PC indicator LED or driver.

The logic circuit for the memory board is shown in Fig. 3. As you can see, this board includes the memory itself, the memory buffer (MB) register, and the memory address (MA) register.

The memory itself consists of two Fairchild type 93415 random-access memory (RAM) devices, although if only a 128-word memory is required, one device may be omitted. Both are needed for the full 256-word memory.

The 93415 device is actually a 1024-bit bipolar RAM, organised as 1024 single bits. However, for this application I have in effect "re-organised" the two devices so that they each store 128 x 8-bit words.

The technique used for this relies on the fact that EDUC-8 is a basically a serial machine, and moves both instructions and data words around one bit after the other, in 8 clock pulse sequences.

The address number fed to the memory devices from the MA register is fed to the 7 most significant address inputs of the 93415 devices, with the 8th and most significant bit used to determine which device is selected. This leaves the three least significant address bits of each device unspecified, so that the addresses provided by the MA basically correspond to groups of eight adjacent memory locations in either one device or the other.

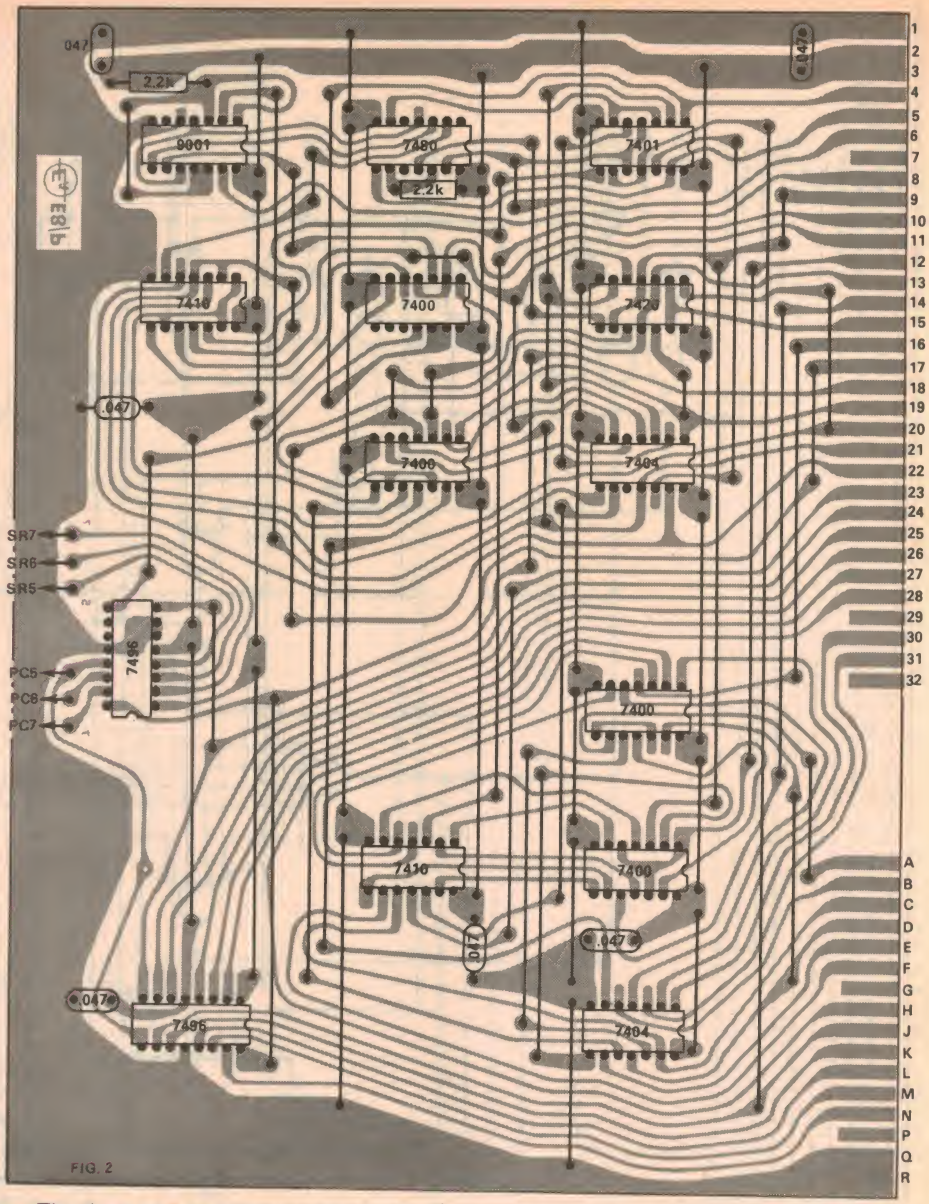


FIG. 2

The three least significant address bits of the memory devices, A0, A1 and A2, are connected together and also to the outputs of a 3-bit binary counter, formed by part of a 7493 device. This has been called the "memory strobe" counter, because its action is to cycle the total memory address applied to the two 93415 devices through the eight appropriate bit positions, during the eight MCP periods in which a word is either written in or read out.

In effect, the strobe counter and the decoding logic inside the 93415 devices for the three least significant address bits form an 8-way multiplexer and demultiplexer, which connects each of the locations in a group of 8 to the write or read circuitry in turn, during an 8-bit write or read sequence. The main "address" specified by the content of the MA simply determines which group of 8 bit locations is involved.

You can visualise this action as one whereby a number is stored by "spraying" its 8 bits into the 8 locations of the group selected by the MA address. Conversely, a number is read out serially by in effect "sniffing" each of the 8 locations at its address, in turn.

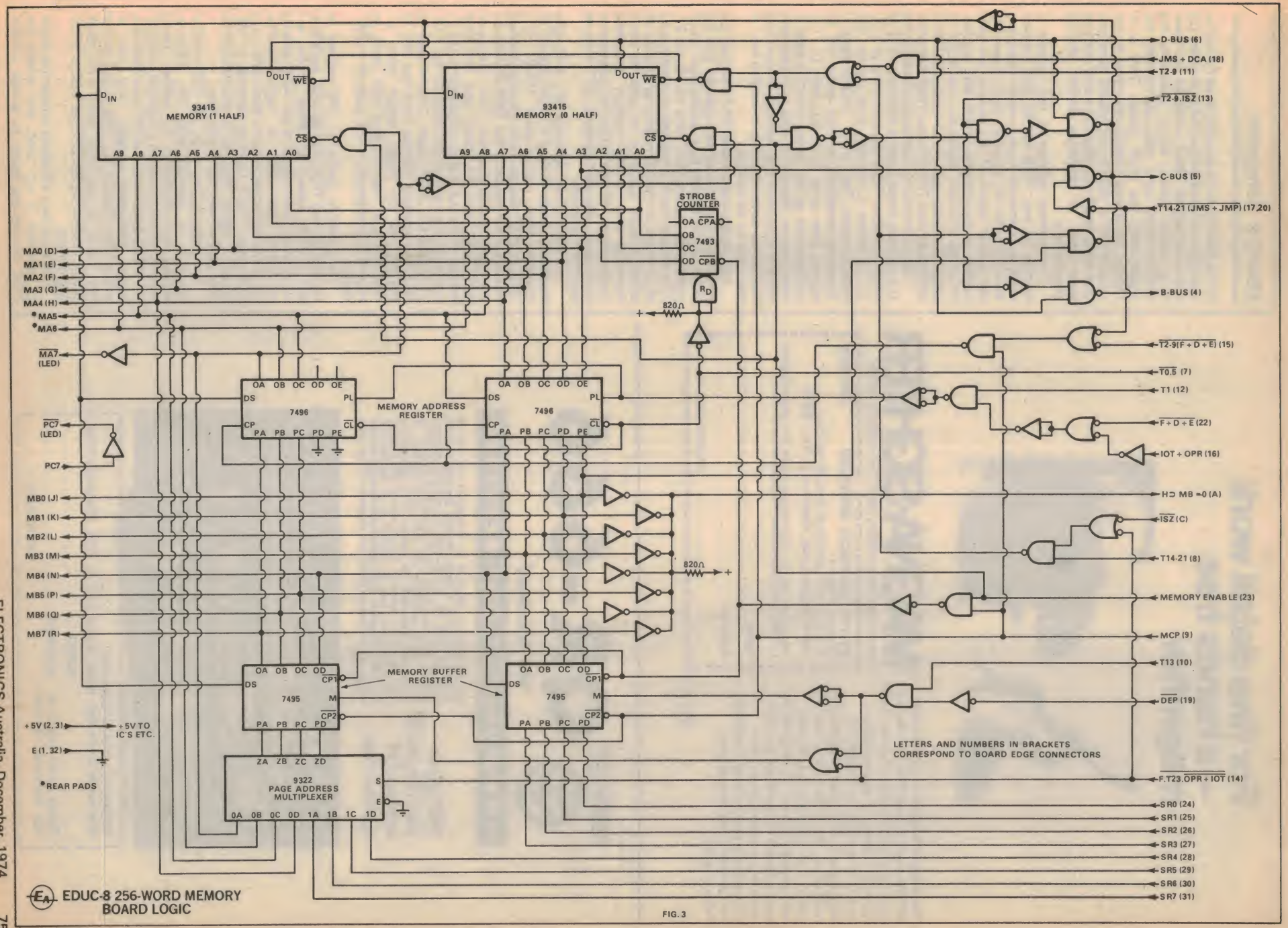
The MEMORY ENABLE signal arriving at pad 23 of the board (from the decoder board) is used to enable the memory devices whenever they are involved in machine operation. The signal is fed to the "chip select" or CS-bar inputs of the 93415 devices via two gates, one fed with the MSB ouput from the MA register, and the other fed with the complement of this signal. Thus when bit 7 of the address is 0, only memory device "0" is enabled; conversely when bit 7 is 1, only memory device "1" is enabled.

The signal from pad 23 is also used to gate MCP pulses to the strobe counter and the MB register devices, so that both operate whenever the memory is enabled.

If the memory devices are enabled with the "write enable" or WE-bar control inputs held at the logic high level, they perform the read function. During the 8 MCP periods concerned the content of the 8 memory locations at the specified address are sensed in turn (non-destructively), and appear one after the other at the Do outputs of the devices, which connect to the D-bus (pad 6).

Further gating also provides a path from the Do outputs to the B-bus (pad 4) during T2-9 of an ISZ execute cycle, and to the C-bus (pad 5) for all read operations other than T2-9. ISZ.

To achieve the memory write function rather than read, the WE-bar control inputs



EDUC-8 256-WORD MEMORY BOARD LOGIC

FIG. 3

EDUC-8 computer

of the 93415 device selected must be held at the logic low level during the time when the device is enabled. This is achieved by means of a "write" control signal, applied to the WE-bar inputs via a gate used to AND the signal with the MCP pulses. This is to restrict the actual writing operation to the second half of each clock period, to ensure that logic levels on data lines and address lines have all stabilised before writing commences.

The memory address or MA register is formed by two 7496 five-bit shift register devices, connected in very similar fashion to those for the PC register. Here, however, the parallel inputs of the devices are connected to the outputs of the MB register. The clear (CL-bar) inputs are connected to edge connector pad 7, so that the MA is cleared at time T0.5 of every machine cycle.

There are only four actual situations when the memory write cycle is required: T2-9 of either a JMS or DCA execute cycle, or T14-21 of either a deposit cycle or an ISZ execute cycle. The "write" control signal is therefore generated by four gates fed by signals from pads 11,18,8,C and 19. The complement of the write control signal is also used to disable the data path between the Do outputs of the memory devices and the C-bus, as this bus line is used to feed in the data to be written.

The parallel load enable (PL) inputs of the 7496s are also connected together, and fed with a signal formed by a simple logic circuit combining signals from pads 12,16 and 22. This causes the MA register to parallel load the number in the MB register at time T1 of either a defer cycle or an execute cycle involving any of the memory reference instructions —ie, time T1 for all cycles other than fetch, deposit, examine, IOT execute and OPR execute.

The MA register operates as a shift-right register at times T2-9 of a fetch, deposit or examine cycle, and at times T14-21 of a JMS or JMP execute cycle. Clock pulses are fed to the CP inputs of the 7496 devices by the gates deriving signals from connector pads 9,15, and 17. Note that the bit-0 output of the MA is also connected to the C-bus line, via a control gate fed with the T14-21. (JMS OR JMP) signal. This is used to feed the operand address from the MA to the PC via the adder, which either increments it in the case of a JMS cycle, or passes it unchanged in the case of a JMP cycle.

The memory buffer or MB register is formed by two 7495 four-bit shift registers, and in that respect is similar to the accumulator. The outputs of the 7495 devices are here also taken to eight inverter elements, wired as before to form an 8-input NOR gate. This is used to generate a "MB equals 0" signal, required for the conditional skip part of the ISZ instruction.

For most of the time, the MB register operates in tandem with the memory, storing and displaying the number being written into or read from a memory location. For these operations the MB operates as a simple shift-right register, and this is achieved by holding the 7495 mode control (M) inputs at low logic level, with clock pulses applied to the CP1-bar inputs when appropriate.

There are two situations where this mode of operation is not used, and where the 7495 devices are made to accept parallel

data input. The first of these situations occurs during time T13 of a deposit cycle, when the parallel inputs of the MB are connected to the switch register switches, to load in the number to be deposited. A T13. DEP signal is derived from the signals on connector pads 10 and 19 for this purpose, and is used to drive the M inputs of the 7495 devices to logic high level for one MCP period. As MCP pulses are connected to the CP2-bar inputs of the devices, this causes loading to occur at time T13.5 of the deposit cycle.

Note that whereas the parallel inputs of the 7495 device corresponding to the 4 least significant bits of the MB connect directly to SR0, SR1, SR2 and SR3, the parallel inputs of the second device connect to the remaining four switch register lines via a 9322 quad 2-input multiplexer device. This is because these inputs must alternatively connect to the outputs of the four most significant MA register, bits, for the second MB parallel loading situation.

This situation occurs at time T23 of the fetch cycle, when a memory reference instruction has been fetched. Here, you may recall, the four most significant bits of the instruction address must be transferred from the MA to the MB, so that the machine will "remember" the page of memory from which it has fetched the instruction. It needs this information to complete the operand address, in the case of a direct memory reference instruction, or the address of the operand address in the case of an indirect instruction.

The switching (S-bar) input of the 9322 multiplexer is normally held at logic high level, and thus the "1" inputs of the device are connected to its outputs. The parallel inputs for the four most significant bits of the MB are thus normally connected to SR4, SR5, SR6 and SR7, and remain so during the deposit operation. However the S-bar input of the 9322 is taken to pad 14, which also feeds through an inverting OR gate to the M input of the coupled 7495. As a result, the arrival of the F.T23. not (OPR OR IOT) (L) signal at pad 14 causes the 9322 to switch the parallel inputs of the 7495 to the MA outputs, from the SR lines, and at the same time the 7495 M input is driven high so that loading takes place.

The wiring diagram for the memory board is shown in Fig 4. Like the other plug-in boards this one also measures 21.5 x16cm, being coded E8/M. As you can see, it involves 18 IC's, a small number of passive components, and again a number of wire links.

Wiring the board should present few if any problems if this diagram is followed carefully. As before the main points to watch are that the ICs are correctly orientated and in the correct positions, and that the wire links are wired correctly.

Note that the memory device positions are marked "0" and "1", to signify which device is designated by the appropriate values of bit 7 of the MA register. In other words, device "0" is that which forms the "first half" of the 256-word memory, and device "1" the second half.

I would suggest that you use sockets for the two memory devices, as they are by far the most expensive ICs in the whole machine. Use high quality sockets, preferably of the "low profile" type so that they do not raise the devices too high from the board. Otherwise you may have trouble with the device packages fouling the decoder board, when the board is plugged in.

Like the program counter board, the memory board has some flying leads connecting to it. As before these have been made necessary because of the expansion of the memory to 256 words.

The two flying leads marked MA5 and MA6 should be fairly self-explanatory. They go to the points on the top edge of the front panel board which are marked (MA5) and (MA6), to drive the appropriate LED indicators.

You may recall that the front panel board has no provision for the eighth indicator LEDs of the PC and MA registers, PC7 and MA7, or for their drivers. These LEDs must be mounted on a small supplementary panel, cut from Veroboard or similar material, which is mounted in front of the front panel board so that the LEDs are correctly positioned in line with the others.

Two inverter elements on the memory board, which would otherwise have been unused, have been arranged to serve as the drivers for the two additional LEDs. The input of the inverter for the MA7 LED is connected to MA7 by the memory board pattern, and only its output need concern the constructor. This is the flying lead marked MA7-bar, which goes to the supplementary panel.

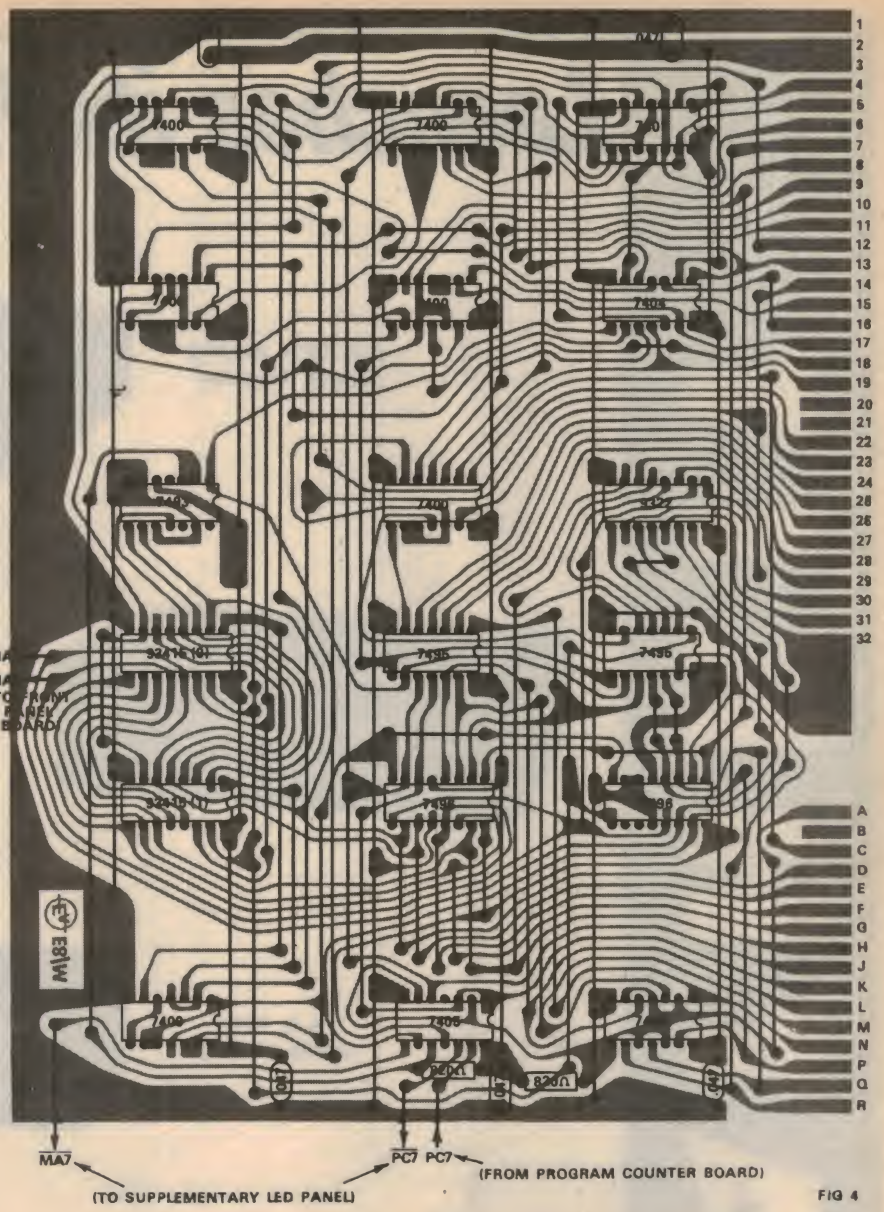


FIG 4

To allow the second inverter to be used as the PC7 driver, a lead must be wired between its input and the PC7 output on the program counter board. This is the flying lead marked PC7. The output of the driver then goes to the supplementary panel, like that for the MA7 LED, via the lead marked PC7-bar.

Details of the supplementary panel used to support the PC7 and MA7 LEDs and their series 180 ohm resistors are shown in Fig.5. The board measures 21 x 32mm, and is cut from a scrap of Veroboard with 0.1in conductor spacing.

Only one conductor strip need be cut on the panel — that third from the top, used for terminating the two resistors and the flying leads to the memory board. Note that the resistors should be the small ¼-watt size, to fit comfortably. The two LEDs should also be of a type having a fairly short body, and mounted hard against the panel to produce a shallow overall assembly.

As shown, the panel is supported in front of the front-panel PC board in such a position that the two LEDs are in line with those in the rest of the array. The panel is supported by two small "U" shaped strips, fashioned from a scrap of 18G sheet brass

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or similar. As well as supporting the panel, the strips also complete the 5V supply connection for the LED anodes, as they are soldered to the 5V copper area on the front panel board.

With both the program counter and memory boards completed and checked over carefully, you should now be ready to try them out. The first step is to plug in the program counter board, after having carefully cleaned its edge connector pads and made sure that it mates correctly with its sockets. It plugs into the mother board in the fourth position down, don't forget, immediately above the accumulator board.

Now turn on the power. Things should be much the same as with the first three boards in position, except that now the LED indicators for the PC register should show some random number instead of being all lit (apart from PC7, which has only just been added).

If all is well so far, set the SR switches all to zero (down position) and press down the load address key. All PC indicator LEDs should go out, and should stay out when the key is released.

Now try loading an address into the PC, by setting the SR switches to a number other than zero, and repeating the process. The LEDs should remain dark when the load address key is pressed, but adopt the bit pattern set by the SR switches when it is released.

Try a variety of numbers in this way, just to make sure that all is well. Note that when the load address key is pressed, the previous content of the PC should be cleared, with the new content being loaded in only when the key is released.

You can now test the PC incrementing function. To do this, set the FAST / SLOW switch to the lower position (fast), and the SINGLE / CONT switch to the upper position (single). Then press the examine key, whereupon the number in the PC should increment — increase by one. Further pressing of the examine key should repeat the process, and in fact you should be able to run the PC right through its full 256 bit combinations, by simply pressing the key enough times.

Pressing the deposit key instead of the examine key should have the same effect at this stage, so try this also. And you can also try pressing the run key, which should have the same effect again, at least in terms of

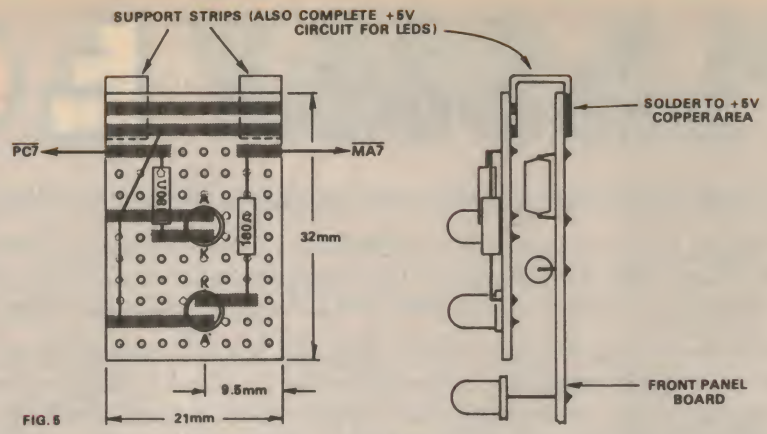

FIG. 5

the PC being incremented. It may also have other effects, depending upon the setting of the SR switches (which will still be doubling for the MB register, assuming you have left in the temporary connections used in the previous tests).

You can now check the "skip" incrementing of the PC, or at least one instance of it — the SZA microinstruction. Do this in the following way. First, set the SR switches to octal 710, corresponding to CLA. Then, leaving the FAST / SLOW and SINGLE / CONT in their present positions, press the run key. This should clear the AC.

Now set the SR switches to octal 730, corresponding to SZA, and note the number in the PC register. Then press the run key again, and you should see the PC increment. Further presses of the run key should produce further increments.

If all is well this far, your PC is working as it should, and the serial adder must also be fairly right. However to test the adder further, you can run through the various OPR microinstructions, and check that they are working correctly.

Perhaps the best one to check first is CMA, whose octal code is 704. So set the SR switches to this, and press the run key. This should cause the AC content to change from all zeroes to all ones. Further presses of the key should simply cause the AC to swing back and forth between these two situations.

You have already tried the SZA microinstruction to check that it causes PC incrementing with an AC content of zero, but just to make sure that all is well, end up the CMA test with the AC set to all ones. Then set the SR switches to octal 730 again, and try pressing the run key. This time the PC should not increment.

Now set the SR switches to octal 701, corresponding to IAC. Pressing the run key should now cause the AC to clear, as the "all ones" content corresponds to minus 1 in 2's complement notation, and minus 1 incremented gives zero. Further presses of the run key should cause further increments, so that the AC content should become 1, 2, 3, 4 and so on.

Now try testing the RAR microinstruction, by setting the SR switches to octal 722. Pressing the run key this time should cause the number in the AC to be rotated to the right by one bit, with the content of bit 0 transferred to bit 7. Each time you press the run key the number in the AC should move by one bit in this way, so that a total of 8 presses should restore the number to its original position.

If you stop the number with a 1 in the bit 7 (most significant bit) position, this will let you try the SMA microinstruction. Do this by setting the SR switches to octal 724, whereupon pressing the run key should cause the PC register to be incremented. Do this a few times, just to make sure that incrementing occurs each time. Then set the SR switches to octal 702 (RAL) or 722 (RAR), and rotate the number in the AC until there is a 0 in the bit 7 position. Now reset the SR switches to 724, and press the run key once more. This time the PC should not be incremented, as the AC content is no longer "negative" (according to 2's complement notation).

The combined OPR microinstructions can also be tested at this stage, although if all has been well so far, they should all work as a matter of course.

Thus CLA.IAC (octal 711) should cause the AC to be set to 1, while CLA.CMA (octal 714) should cause it to be set to minus 1 instead. Similarly CMA.IAC (octal 705) should cause the number in the AC to be changed into its 2's complement, while SZA.SMA (octal 734) should cause the PC to be incremented if the number in the AC is either zero or negative.

Having now tested just about all of the functions of the machine in its incomplete form, the next step is the big one: adding the memory board, to complete the basic machine and make it capable of running.

Prepare for this by turning off the power, and then removing the temporary connections between the SR switches and the MB register outputs.

Note that if you have only one 93415 memory device at this stage, it would be best to plug it into the "0" socket. The discussion which follows will in fact assume that this is the case.

Clean the edge connector pads on the

EDUC-8 COMPUTER PARTS LIST — 3

PROGRAM COUNTER & ADDER BOARD

1 PC board, code E8/P, 21.5 x 16cm
5 7400 or 9002 quad 2-input gate IC
1 7401 or 9012 quad 2-input gate with open collectors
2 7404 or 9016 hex inverter IC
2 7410 or 9003 triple 3-input gate IC
1 7480 or 9380 gated full adder IC
2 7496 or 9396 5-bit shift register
1 9001 high speed J-K flip-flop
2 2.2k ¼ W resistor
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Insulated hookup wire for links, flying leads.

MEMORY BOARD

1 PC board, code E8/M, 21.5 x 16cm
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1 7401 or 9012 quad 2-input gate with open collectors
1 7404 or 9016 hex inverter
2 7405 or 9017 hex inverter with open collectors
1 7493 or 9393 4-bit counter
2 7495 or 9395 4-bit shift register
2 7496 or 9396 5-bit shift register
1 9322 quad 2-input multiplexer
2 93415 1024-bit RAM (or only 1, for 128-word memory)
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memory board carefully, and plug it into the sockets on the mother board between the program counter and decoder boards. Then turn on the power once more.

Set the SR switches to zero (all down), and load this into the PC by pressing the load address key. Then, with the SLOW / FAST switch set to the down or fast position, press the examine key. A random number should appear in the MB register, representing the turn-on bias bits of the flip-flops in the first 8 bit locations of the 93415 device in the "0" memory socket.

Press the examine key a few more times. This should bring out more random numbers into the MB, probably a different number each time (but not necessarily).

Now you can try loading in a few numbers, using the deposit function. To do this, first load a suitable starting address into the PC, by setting it up on the SR switches and pressing the load address key. You can load in any convenient starting address you fancy, although an easily remembered one is the very first: location zero.

After having loaded the starting address into the PC, set up a suitable number on the SR switches. Then press the deposit key, and you should see the number appear on the MB registers LEDs. At the same time the starting address should have transferred from the PC to the MA, while the PC content should have incremented.

If all seems well, set up another number on the SR switches, and press the deposit key again. The process should be repeated, with the new number appearing in the MB. Note that you do not have to load in a new address for the second deposit, because the PC has already incremented after the first. You can deposit a third and fourth number (or more) if you like, by further deposits.

By these steps, you should have stored the numbers into a consecutive group of memory locations. To check that this has in fact happened, set up your initial starting address again on the SR switches, and load it into the PC with the load address key. Then press the examine key, and the number you stored in the first address should appear in the MB again. Further presses of the examine key should cause the second, third, fourth and other numbers stored to appear also.

If all is well so far, the odds are that your memory is working correctly, and the machine should now be capable of running. So probably the best thing to do next is to load in a simple program, and see if it runs.

The simple test program shown is probably a good one to try, as it is quite short and easily loaded. Don't worry too much about the program itself, as we will deal with programming soon. At this stage all you need to know is that it is a very simple one, using mainly the ISZ and JMP instructions, which causes the accumulator to be incremented 256 times.

First set up a suitable starting address on the SR, and load it into the PC. Then deposit each of the eleven octal code numbers of the program in turn, as before. After this has been done, check that you haven't made any mistakes by loading the starting address into the PC once again, and examining the stored numbers. If they check out correctly against the list, you are just about ready.

The final step in preparation is to move the SINGLE/CONT switch to the down position, to allow the machine to run continuously. The FAST/SLOW switch should already be in the down position, for fast operation, and this is correct.

EDUC-8 PROGRAM "FIRST TEST"

STEP	MNEMONIC	CODE
0	START, CLA	710
1	INCR, IAC	701
2	BACK, NOP	700
3	NOP	700
4	ISZ INDX	211
5	JMP BACK	502
6	ISZ INDY	212
7	JMP INCR	501
10	HLT	721
11	INDX, 0	000
12	INDY, 0	000

A simple program you can use to check that your machine is capable of running. It merely increments the AC register 256 times, and then stops.

Are you ready? All you have to do now is load the starting address once more into the PC, and press the run key.

Upon doing so, the RUN indicator should light, with the FETCH and EXECUTE indicators also lighting a little less brightly to indicate that the machine is flitting back and forth between them. The ISZ, JMP and OPR indicators should also be partially lit, showing that the machine is doing these types of instruction.

But more dramatic than these should be the AC register LEDs, which if all is going well will be showing a brisk counting operation. The binary number in the AC should be incrementing, probably at a rate just too fast for you to keep track. The indicators for the PC, MA and MB registers should all be partially lit, perhaps with some brighter than others, indicating that these registers are involved in a lot of dynamic activity.

In the discussion of progress testing given at the end of the description of the timing, decoder and accumulator boards, it was stated that the CMA microinstruction could be tested with only these plug-in boards in position. In fact this is not so, as the CMA recirculation loop uses the serial adder as its return pathway. So if you tried this test and it didn't work, don't worry!

The CMA microinstruction will work correctly when the program counter board is now added, however, as described in the present discussion.

If you have had trouble in finding a reservoir capacitor for the power supply, please note that 33,000uF 25VW units are readily available from Siemens Industries. Order via your supplier.

This situation should continue for about 30 seconds, until the accumulator fills up and overflows. The machine should then promptly stop running.

If you used location zero as your starting address, as shown, the registers should now show the following octal contents:

PC: 011 MB:721
MA: 010 AC:000

If this is the case, you can be fairly sure that your machine is working correctly. At this stage we have not tested some of the memory reference instructions, but this can wait. For the moment, you will no doubt want to try feeding the test program into other parts of the memory, and make sure that it runs there also.

You can also try setting the FAST/SLOW switch to the upper or slow position, and try running the program at the slow clock rate. This will enable you to follow its operation in detail, as it fetches out each instruction and then executes it.

But please note one important point: when depositing or examining, ALWAYS make sure that the FAST / SLOW switch is set to the down or fast position. Otherwise, the machine will not correctly recognise that a deposit or examine cycle is required, and will start running. This will do no harm, but can be annoying!

Incidentally, you don't have to feed in the test program again simply in order to re-run it; merely load the starting address into the PC as before and press the run key. That is all, unless of course you want to store it in another part of the memory, and run it there. In this case, you will have to feed it in again.

Your machine should now be ready for the addition of the sixth plug-in board, the input-output transfer or IOT interface board. This will be described next, along with a simple input keyboard device and a simple output display — your first two "peripherals".

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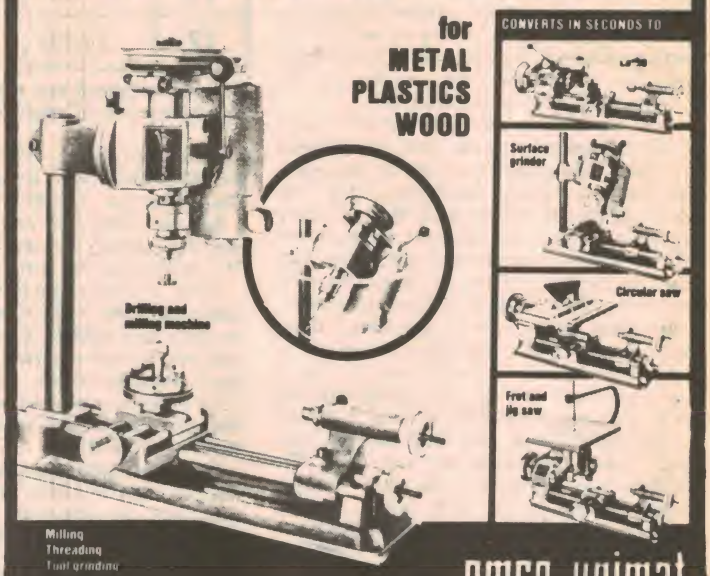

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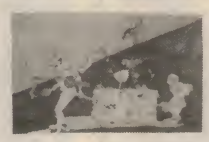

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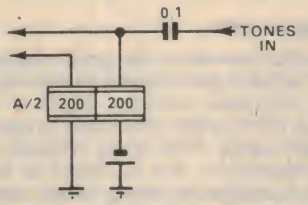
Telephone exchange

Readers contemplating building the Automatic Telephone Exchange described in the July, 1974, issue will be interested in a number of alternative arrangements suggested by a reader. These are aimed at eliminating some of the more specialised telephone components which may be difficult to obtain.

by N. J. DIENER*

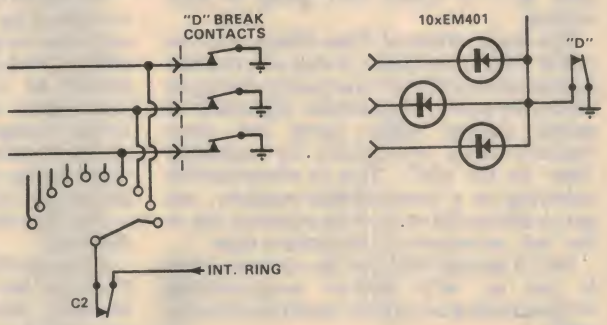
Having built the telephone exchange described in the July issue, I feel that readers may be interested in a few simplifications I have devised.

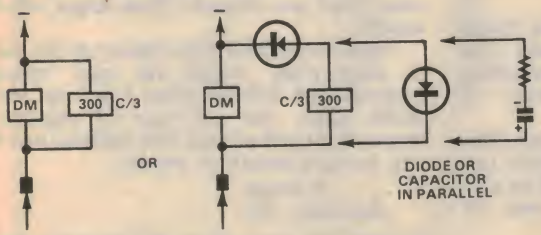
The D relay requires 11 break contacts and 1 change over contact (for 10 lines). Nine of the break contacts can be eliminated by using 10 silicon diodes (EM401 or similar) connected as shown. The D contact, when closed, connects all the leads to chassis through the diodes, but the diodes isolate the wires from the line relays and from each other.



For this simple exchange it is possible to dispense with the tone winding on the "A" relay and substitute a capacitor.

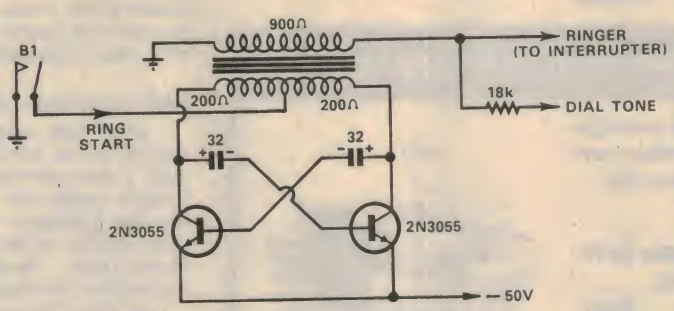
The large number of contacts called for on the "D" relay may have deterred some would-be constructors. A network of isolating diodes as shown is not only more convenient but, in some ways, a more elegant arrangement.





In the original design the "C" relay had a low resistance (5 ohm) coil and was connected in series with the uniselector coil. The alternative is a higher resistance coil in parallel.

This generator will provide enough power at 33Hz to operate the bells, the lower frequency making the adjustment of the bells less critical. See text for details of the transformer.



The C relay with a 5 ohm winding, originally specified, posed a problem. The lowest resistance coil on hand was 50 ohms, and this was too high to use in series with the uniselector drive magnet.

The solution was to connect a 300 ohm coil in parallel with the uniselector magnet. This worked quite satisfactorily but, if the C relay releases too quickly, it will need a diode or capacitor network to increase the release time. (Editorial note: If a capacitor is used a small amount of resistance would be connected in series to protect any associated contacts.)

The ring and dial tone generator was designed around an interstage transformer discarded from a transistor radio. It was equipped with a 400 ohm centre tap winding, and a 900 ohm winding. It was relatively large, approximately 1¼in in each dimension. Smaller types may not generate the necessary power. The circuit operates at approximately 33Hz.

The final problem concerned the A relay. A relay having a tone winding was not available, but this was overcome by using a coupling capacitor, as shown in the circuit.

These ideas may help other constructors to achieve success in the project, or encourage them to tackle it.

*Flat 5, 450 South Rd, Marleston, SA 5033.

Letters to the editor

The views expressed by correspondents are their own and are not necessarily endorsed by the editorial staff of "Electronics Australia". The Editor reserves the right to select letters on the basis of their potential interest to readers and to abbreviate their contents where this appears to be appropriate.

Test cassettes?

Just recently I have had to replace the head, oscillator coil and preamp IC in my cassette machine. Now according to me, the bias levels, and recording levels will need adjusting, and this is in fact stated in the service manual. But in order to do this a test cassette with pre-recorded tones at different levels and frequencies is required.

I have been told by the company concerned that no such cassette is available, and that this readjustment isn't necessary. This I don't believe, and I'm frankly disgusted with their attitude.

Do you, or any of the readers, know of a suitable test cassette that is available? If not, it seems to me that one of the cassette companies should produce one. Perhaps then the service on cassette recorders would improve.

I. Morrison (Hermit Park, Qld.).

COMMENT: A pre-recorded test tape won't be of much use in readjusting recording or bias levels, which are best adjusted using an audio oscillator and level-distortion meter. However, it would certainly help in adjusting head azimuth. As we noted on page 9 of the June issue, a fairly wide range of Philips test cassettes is available from United Electronic Servicing Pty Ltd, of 443 Concord Road, Rhodes, NSW 2138. The range includes cassettes to test both frequency response and azimuth.

Colour bar

I often wonder at the petty-mindedness of our socialist government in demanding that the television stations insert a 4.43MHz notch filter in the video chain to prevent any colour signal from being radiated.

Presumably, this is aimed at those few who do happen to own a colour receiver, in attempting to prevent them from installing a 'Chroma-lock' and viewing some programmes in colour now — so, what if they do?? It surely isn't going to hurt anyone.

The major effect of these filters, and the one of which I complain, is that of a marked degradation of the picture quality during an otherwise colour programme, especially at colour change edges (note the news reader's head surrounded by annoying 'dots' on the ABC). This is exceptionally annoying on a monochrome receiver, but not so noticeable on a colour receiver due to the 'dot' structure of the picture tube.

Isn't it enough that we, the viewers, have to put up with inferior programming without having an inferior quality picture as well?

Now that all Sydney channels have finally succumbed to Government pressure, this leaves us with four TV stations transmitting poor quality pictures, and in many instances, programmes as well.

I wonder if the insertion of the notch filter in any way contravenes the standards laid down very carefully by the ABCB to give Australia one of the world's best TV systems.

The only other alternative, if the Government wants to be so pedantic, is to ask all stations to use only their monochrome equipment on any programme going to air, thus avoiding the annoying 'fringes' at colour change edges.

D. R. Hegarty,
Randwick, NSW.

COMMENT: As noted in the November leader, the situation does seem to have become rather Gilbertian. Your point about a comb filter possibly contravening ABCB regulations is an interesting one; have you sought comment from them? Happily it won't be long now before the question is an academic one, and you'll be able to watch your colour programs unfettered by either chromalock or filter.

Rapid PC drilling

Following on from your item on rapid etching of printed circuit boards using a mixture of Hydrogen Peroxide and Hydrochloric acid, I would like to recommend a method that I have devised for rapid drilling of boards so etched.

The board is mounted vertically in a vyce or similar jig at one end of the work bench and a twelve gauge shot gun mounted at the other. Using sparrow shot, sufficient holes should be made in the board to accommodate most components; holes for larger components can be made using standard shot. Relays and the like can be fitted using single ball cartridges which make quite a large if somewhat jagged hole — but this can be cleaned up with a file if required.

A range of 2-3 metres for fibre glass and 5-6 metres for phenolic boards are recommended, double sided boards requiring about 20pc less distance than single sided boards.

I hope to continue experiments on the use of steel plate masks for high speed programmed drilling when I am up and about again (the pathways of amateur research are not without their pitfalls) and I will forward details of results.

R. Roper
Hawthorn, Vic.

COMMENT: Point taken. We hope you are on your feet again soon, and wish you luck with your experiments. You may need it!

FM coverage unfair

I read with surprise your optimism in regard to the introduction of the FM service. I am referring to "HiFi News" September under the heading, "Will FM be shunted sideways — again?". Also to October edition under the title of, "Frequency Modulation Broadcasting: Proposed Australian Standards."

I am sure that you are aware of the work being done by the "Music Broadcasting Society of NSW" viz the tests carried out at the 'Sounds Spectacular 75' exhibition at Centrepoint, which you gave so much prominence to in your magazine, and later at the 1974 HiFi exhibition at the Koala Motor Inn. You may argue that these tests came too late for inclusion in your magazine, maybe — but you are not giving the public a clear picture of what is happening in this field.

Are you aware that FM stereo tests are expected to start on or about November 1st? Are you aware that Mr. Jeff Rushton, Assistant Secretary (Radio), of the Department of the Media on addressing the M.B.S. on 30th July, 1974 denied a similar

article as your September accusing the department of disinterest in getting FM off the ground. I feel it is your duty to your readers to give them the true picture of what is happening. It seems in this subject the national dailies have given a better picture. All being well FM stereo will be under test by the time the November edition comes out so don't be so out of date.

Referring to the letter by J. Brown (October P. 105). I disagree that the component situation is the fault of the Australian Government. But I do agree that little problems arise by purchasing from overseas firms especially UK ones. I first started importing records about 15 months ago because of the low local standards. I was surprised to find this a lot cheaper. I have now extended my purchasing to HiFi equipment and more recently to components. If the UK can give such good service under its present financial difficulties then what's wrong in this country? I doubt that this will be published but my advice to readers especially those who depend on mail order is to purchase from overseas.

R. G. Fletcher
Spit Junction, NSW.

COMMENT: With greater frequency and space, the daily papers can afford to devote much more space than we to expectations, as opposed to facts. We are aware that the Music Broadcasting Societies in both NSW and Victoria hope to have experimental FM transmissions going before the end of the year, and wish them all success. But this will still be a long way short of full scale nation wide FM broadcasting, about which things seem to have gone strangely quiet. We leave readers to decide whether we are out of touch, or unduly pessimistic.

AM tuner designs

As a dedicated reader of your magazine for 25 years, I must take you to task over your presentation of radio tuners in recent years. You seem to have fallen into the habit of describing new types of tuners without adequately revealing their limitations.

Being something of a sucker for innovation in this area, I have built various designs, both for my own use and to help out impecunious friends with a desire to listen to good music via the ABC.

In general, the Playmaster 122 has provided years of good service, but the potential shown by the Homodyne in a direct comparison, in the area of distortion and frequency response (electrostatic speakers, etc), is unsettling. However I feel that a tuner must first separate stations with no appreciable background noise; then, and only then, can the bonus of frequency response and low distortion be appreciated.

What about tuning the interstage coupling on the Homodyne, using one of the tuning units with three coils? This was suggested by the author, and I would think a slight reduction in high frequency response to improve selectivity could be tolerated.

G.W. Wylie
Lane Cove, NSW.

COMMENT: The original Homodyne design was published mainly because we believed readers would find the concept an interesting one, and worth developing further. The selectivity of the basic design has proved marginal for Australian conditions, we agree, and your suggestion seems logical.

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The unit comes complete with an AD K5E magnetic cartridge with elliptical diamond stylus and can be supplied with a teak plinth and smoked perspex cover.

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BSR 550 Magnetic Automatic/Manual Turntable $123.82*

The best performing turntable in its price class. The 550 is well suited to any quality audio system. A synchronous motor insures low wow, flutter, and rumble, and unvarying speed regardless of the number of records on the platter or variations in electric voltage. The tone arm system is the same used in the 660, complete with a viscous-damped cue/pause control mounted on a handsome teak base, with tinted dust cover, and ADC K8E cartridge and elliptical diamond stylus.

BSR HT70 Four Speed Single Play Turntable $137.45*

This is a high precision luxury player ideal for that select group of enthusiasts who insist on manual operation. It features a deep rim, diecast turntable weighing 4½ lb, engineered to provide a perfect tracking angle, a rotating stub spindle which avoids centre hole wear on your records, and a fully synchronous dynamically balanced 4-pole motor to lock on to the frequency and compensate for fluctuations in the mains voltage. It features the BSR anti-skate force control and a low mass tone arm supported on ball race bearings, fitted with an ADC K7E cartridge.

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Classical Recordings

Reviewed by Julian Russell

Toscanini — four superb discs

RCA are doing music lovers a great service by issuing splendidly reprocessed recordings by the great Arturo Toscanini, most of them originally recorded in mono during the early 1950s and 60s. Also not to be ignored is the fact that these discs are offered under RCA's economy-priced Victrola label.

RICHARD STRAUSS — Tod und Verklarung. Till Eulenspiegels Lustige Streiche and Don Juan. Played by the NBC Orchestra conducted by Toscanini. RCA Victrola Mono VVM1-7004.

I found that, on my equipment, a bass boost helped the sound in which the clarity of the playing is still to be revered. To this, in all three Tone Poems, can be added Toscanini's indomitable drive. The woodwind timbre is quite distinctive and faithful and the timpani recorded as discretely as they were used in the live performances of this work. The very loud tuttis of the augmented Straussian orchestra sometimes sound a little congested by modern standards but this is more than amply balanced by many other fine features. Toscanini uses no false heroics. He even gives the final Redemption theme a stateliness that goes far to disguise its banality. Nowadays you'd hear more of the recorded brass in the climax of this theme but I was left unworried by this minor shortcoming. I have chosen this work to review first because it was the only one of the three on the disc that caused me any slight discomfort. The other two are grand.

In Till Eulenspiegel Toscanini, whose reputation as the strictest of martinets still lingers, displays a sense of humour that will surprise only those who never heard him conduct Verdi's Falstaff. During Till you will have to put up with an awkward turnover, though it comes in about as convenient a place as any. The many changes of moods and tempos are dealt with so smoothly that they don't cut the work up into brief episodes but preserve its continuity. The engineering is very clear and the brass in much better balance in the climaxes. You will hear some truly wonderful horn work and the trumpets and trombones are always fine without any unseemly glare. Indeed Toscanini's treatment of the brass section reminds me of Strauss' advice to a pupil — "Never look at 'em, my boy. You'll only encourage 'em.". The epilogue is delivered with great beauty but entirely without sentimentalisation.

Don Juan rushes impetuously into its magnificent opening. Here is true fire that one feels could quite easily catch alight. In this work too there is admirable clarity in the tuttis, while the love episodes have unmatched ardour. There are some seraphic solos from the first desk reed players but no vulgar spotlighting of them. My overall impression of the performance was one of terrific urgency never taken to to the point of recklessness. And guess who wrote the sleeve notes — Spike Hughes!

★ ★ ★

PROKOFIEFF — Symphony No. 1 in G (Classical).
SIBELIUS — Finlandia.
KODALY — Hary Janos Suite. NBC Orchestra conducted by Toscanini. RCA Victrola Mono VVM1-7006.

The mono sound is fine and you will need no bass boost here. After playing the first disc I turned the gain down a little. Toscanini's tempo in the first movement is a little faster than that of most other conductors'. And in this too you have the same irresistible drive interrupted by passages of the utmost delicacy. The great contrast achieved by the slow opening of the second movement might explain the speed of the first. Here all is elegance you'll be lucky ever to hear again. The wonderfully sturdy Gavotte movement is full of lighter colour changes. And I have never heard the Finale go so fleetly yet without a single stumble or falter. It is an extraordinary exercise in seemingly effortless accuracy.

Finlandia has all the patriotic fervour you'd expect. The sound here is a little on the hard side but many might think this suitable. The processing is so good that even the triangle can be clearly heard. In this item a little bass boost again helps, especially the tone of the brilliantly used brass.

In Hary Janos you'll need more gain to bring in the whispered passage that follows the opening explosive chord. But leave the gain on so that when you reach the second band, the Viennese Musical Clock, you will get the full benefit of the delightful scoring. Do the same for the following Song, fairylike in its fragile gracefulness. The cembalom is very well reproduced indeed. The Intermezzo is "echt" Hungarian and here you can delight yourself by listening particularly to the horns' staccato bars in the middle section. (I turned the highs down a bit for this.) The Finale is consistently exciting and here you might gainfully give particular attention to the unanimity of the string trills just before the coda.

★ ★ ★

MENDELSSOHN — Symphony No. 4 in A (Italian).
SCHUBERT — Symphony No. 9 in B Minor (Unfinished). NBC Orchestra conducted by Toscanini. RCA Victrola Mono VVM1-7002.
BRAHMS — Piano Concerto No. 2 in B Flat. Vladimir Horowitz and the NBC Orchestra conducted by Toscanini. RCA Victrola Mono VVM1-7003.

This performance faces, of course, very stiff competition from more recent recordings on the same and other labels and the many different interpretations by soloists and conductors. But the Toscanini-Horowitz is still worthwhile property to own, especially at its attractive price. I thought the opening of the first movement sounded a little matter-of-fact. I also thought, despite apparent incongruity, that the piano part was a bit on the showy side — the last thing one would expect to come across in Brahms. Horowitz' playing is faultless technically but to me he presents the movement as if he were trying to popularise it. No doubt there are many admirers of this poster-type public relations style, which seems all the more evident against the background of Toscanini's much more pure intentions.

There were, however, bars in which even that stern purist gives the impression of leaning a trifle towards the soloist's style, but after all that's the function of every good accompanist. I still remember the clashes between Szell and Schnabel during rehearsals of Brahms' First Piano Concerto during their Australian tour some 30-odd years ago. Each had his own idea of just how the work should be interpreted and the end result was a compromise by both. After all there are limits to how much even the greatest conductors can impose their will on a soloist. But even in this first and least

The Toscanini story — a great musician

Toscanini established a now legendary reputation by conducting mainly operas and the 19th century romantic repertoire. He chose these works — or indeed they were demanded of him — because he was for many years a peripatetic artist attached permanently to no one organisation but travelling extensively to wherever his engagements took him. In the last years of his life he was appointed permanent conductor of the NBC Orcestra in New York and at an age when most men think of retiring he extended his repertoire, up-dating it to include works of more-recent origin.

We can now benefit from this heritage. To many of the younger generation of record buyers hid is merely a name to be spoken in reverence without ever having heard a bar of anything he conducted. Now they can judge for themselves just how great a musician he was.

I many of these newly processed discs you will be surprised at the quality of the mono sound and the almost complete absence of surface noise. I propose to review here the first four of the series which will eventually include most of his major recordings.

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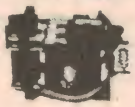

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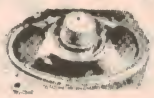

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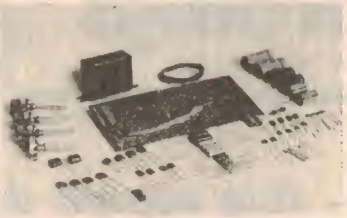

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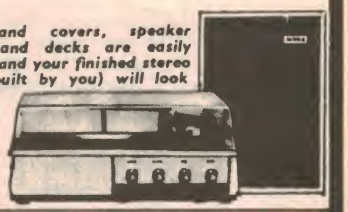

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satisfying movement in the concerto Horowitz' expert pianism is often a sheer delight to listen to whether or not you agree with his reading. However, it is the slow movement, one of Brahms' loveliest, with which I found myself quite enchanted. Apart from the beautiful shaping of every phrase, the balance between soloist and orchestra is never less than perfect. This shows up to even greater advantage since it follows the second movement's heavily accented lumbering 3/4 theme where Horowitz calls to mind an aristocrat posing as a peasant. The Finale goes along in a blaze of virtuosity from both soloist and orchestra, sometimes gauzelike in texture, at others as sturdy as the best quality tweed. There is a momentary race of surface noise towards the end of the slow movmement otherwise with a slight bass boost the sound is very good.

★ ★ ★

MENDELSSOHN — Symphony No. 4 in A (Italian).
SCHUBERT — Symphony No. 8 in B Minor (Unfinished).
RCA Victrola Stereo VVM1-7002.

The first movement of the Mendelssohn is as sunny as you'd expect though it acquires, without damage, a solidity I've never heard before. It is also superbly rhythmic. There is an out-of-doors briskness about the whole work, even in the pious-sounding theme in the second movement, marked, by the way, andante con moto, and taken a little on the fast side despite the composer's instructions. You may not agree with this tempo, but to me it sounds fine. There are, of course, many examples of faster-than-usual Toscanini tempos in spite of his claim to always follow the composer's markings. Did his relentless energy at times frustrate his intentions? At any rate you may be sure that Toscanini never departed from the printed score without very good reasons though they might well have been his very own.

The third movement is full of subtle contrasts in tempos and sonorities, followed by the final Salterello which goes at an exhilarating speed without ever showing the slightest trace of unsteadiness. Here is another example of fleet accuracy nuanced with the utmost subtlety.

There is plenty of drama in the first movement of the Unfinished despite the overall lyricism of the music. Indeed it is this drama that Toscanini emphasises. He succeeds marvellously in making some passages sound really sinister in their despair. The texture is rich but I still added a little bass boost.

Toscanini's treatment of this movement makes of the second a complete contrast. Too often those musicians who regard Schubert as a heavenly melody maker — as he undoubtedly was — take the first movement in a way that brings it into too close a resemblance to the atmosphere of the second. But Toscanini inflects this latter movement with the greatest sensibility imaginable. At times it yearns, at others muses poetically, and now and again asserts itself, crushing all contradiction. Toscanini's is a highly personalised and most moving interpretation.

Considerations of available space make it necessary for me to hold the fifth record in the issue, a disc of Haydn symphonies, over until next month.

VERDI — Attila. Complete opera. Ruggero Raimondi (Attila); Sherrill Milnes (Ezio); Cristina Deutekom (Odabella); Carlo Bergonzi (Foresto); Ricardo Cassinelli (Uldino); Jules Bastin (Leone), with the Ambrosian Singers, Finchley Children's Music Group and the Royal Philharmonic Orchestra conducted by Lamberto Gardelli. Philips Stereo 6700 056. (Two discs.)

Even in Verdi's very early works there are shafts of brilliance though to reach them one had often to plod through much that was mediocre and some of it downright vulgar. His musical characterisation was often — though by no means always — two dimensional. His orchestration was consistently bold especially when the scoring of most of his Italian contemporaries is remembered. And I have not forgotten, by the way, his oft-repeated tum-tum accompaniments.

Nowadays, many of these works are being revived, not merely as curiosities but because of their crowd-drawing potential. One only has to recall the recent success of the Australian Opera's production of Nabucco as proof. Verdi was so prolific a composer that the public, unless they consult a musical dictionary or handbook, has very little idea of the chronology of all but the late middle and final period operas.

Attila was first produced in 1846 when the composer was 33 years old, but already with some solid successes behind him, especially the still-popular Ernani. Eri Tu, the baritone aria from this work, still seems imperishable. It remains in every baritone's repertoire and when well sung can still thrill many listeners, including this one.

Attila has more than its share of good things. Some of the male choruses, and later the full choruses, splendidly sung in this recording, are thrilling. So, too, are many of the vocal solos. There are, however, stretches when the attention is under pressure not to wander but even in these spots there is always the direction of Lamberto Gardelli to enjoy and admire. He has Toscanini's talent for making even the most banal of the tum-tum accompaniments sound significant. All this is made even more attractive by the clarity and balance of the recording. And the score is full of surprises. The male duet in march time at the end of the first act might well have been of little consequence until the startling harmonies just before the end are reached.

In Act 2 the opening storm music is, in its own way, every bit as good as that in Wagner's Flying Dutchman. It would be no idle claim to state that there are more than enough good things in Attila to carry one over the less attractive moments. The libretto might well nowadays be regarded as presposterous nonsense, but time after time a dramatic incident is introduced that makes one, even while listening to a recording and not watching a stage, sit up in astonishment. But it is in the big ensembles that Verdi, even at 33, already had unique resources of stunning originality on which to draw. Much of this in the recording under review is the result of Gardelli's masterly handling of the score, not only in the field of massive effects but also in passages of enchanting delicacy.

There are also some fine solos, and in these, Gardelli, though always a most sympathetic accompanist, sets his mind firmly against those singers taking unwarranted liberties with the text. Among the principals, sweet-voiced Carlo Bargonzi sometimes strains a little for a top note but elsewhere retains his characteristically silken quality. The production of his head notes could be studied profitably by every potential operatic tenor. They are especially delightful at the end of his aria in which he laments the absence of his lover and then goes on to prophecy the building of Venice on the Adriatic swamp on which he is standing. Gardelli wins luscious tone from his strings in Odabella's "Liberamente" aria and later quite wonderful sensitivity in the latter part of this most-affecting song. And Christina Deutekom, who plays the part, is now showing so much improvment on her previous recordings that she can safely be marked out for future greatness.

I must confess to some slight disappointment in Ruggero Raimondi as Attila. His voice, though pleasant enough, lacks the authority that should expose the character of one of history's most ruthless conquerors. On the other hand Sherrill Milnes (Ezio) is able to transcend even the most banal of some of the passages allotted to him. I have mentioned elsewhere the splendid work of the chorus, the Ambrosian Singers, who till now have had nowhere near the success in operatic work that they have here. The Royal Philharmonic Orchestra is consistently eloquent and fresh sounding. The engineering is first rate with, importantly, a well-calculated balance between it and the singers. Philips promise more complete recordings of early Verdi operas. If they are all as good as this one, don't miss them.

I am holding over a review of Penderecki's Utrenja until next month. It is a work that demands much concentration from the listener that can only be acquired by repeated playing.

Variety Fare

Reviews of other recordings

Devotional Records

CHRISTMAS WITH DAVE BOYER. Stereo, Word WST-8612-LP (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals).

According to the jacket notes, Dave Boyer worked the night club circuit for twelve years under the name Joey Stevens, ending up frustrated and depressed. The Christmas songs presented here spring from a new outlook and a new set of christian values: Mary's Boy Child — O Holy Night — What Child Is This? — A Candle In The Shadow Of A Cross — Carol Of Christmas — Silent Night — What Did You say Was The Baby's Name? — Sleep Holy Child — The Virgin Mary Had A Baby Boy — Nobody Wanted Him and Have You Any Room For Jesus?

Dave Boyer has a pleasant baritone voice and understandably, some characteristics and mannerisms that carry over from his club work. In fact, the sound and arrangements could have come straight from a well-produced TV special. In all, a pleasant mix of traditional Christmas melodies, glossy arrangements — and touches of calypso! (W.N.W.)

★ ★ ★

THE ORGAN IN WORSHIP. Donald L. Westfield, Organist. Allen Digital Computer Organ of Trinity Lutheran Church Davenport, Iowa. Allen Organ Company. Stereo DLW-1014.

This appears to be the latest relase in the series of recordings of Allen Digital Computer Organs. The organ on this occasion is the same as that used for another review elsewhere in these columns — with organist Donald L. Westfiel, who has been featured in earlier releases. Mr Westfield is Associate Organist at the Fountain Street Church, in Grand Rapids, Michigan.

As always, the recording is technically good and the items on this disc should interest many church organists and others interested in this type of organ music. It is a fine program made up of old familiar hymns and other well known items of church music. There are times when the organ sounds grand and pleasing and with some fine Vox stops, but I cannot always agree with Mr Westfield's choice of some other stops — at times the reeds are rather hard and edgy. However, on the jacket is printed a most impressive stop list and there are obviously many alternative stops available to the organist who may wish to choose a different sound.

Side 1. Agincourt Hymn, John Dunstable — The Lost Chord, Sir Arthur Sullivan — Lyric Interlude, Alexander Schreiner — St Anne (O God, Our Help in Ages Past) — Olivet (My Faith Looks Up to Thee), Lowell Mason — Duke Street (Jesus Shall Reign where'er the Sun), John Hatton. Side 2. Psalm XIX, Beredetto Marcello — Alle Menschen Mussen Sterben (Choral Prelude), Johann Sebastian Bach — Fugue on the "Kyrie", Francois Couperin — Mercy (Holy Ghost, with Light Divine), L. M. Gottschalk — Hallelujah! Chrous (from Messiah), George Federick Handel.

If you are interested in the Allen Organ and the music featured, then this is a worth while addition to your collection. Copies are available by post, for $5.00 each, from Allen Digital Computer Organ Studios (Aust.), 32 Woodhouse Road, Doncaster East, Victoria 3109. (I.L.P.)

★ ★ ★

THE RICK POWELL CHOIR BOOK. Stereo, Word WST-8597-LP (From Sacred Productions Aust, 181 Clarence St, Sydney, and other capitals).

"Praise the Lord with timbrel and dance, psaltery and harp . . ." Rick Powell doubts his ability with some of the biblical instruments but he and his group do their best to "Praise the Lord" with chorus, piano, bass, guitars, percussion . . . and a synthesiser!

The end result is sound which is modern, highly professional, very listenable and very cleanly recorded. And while the recording is plain stereo, it decodes beautifully and appropriately into 4-channel surround.

The offerings from The Rick Powell Choir Book include: Joyful Noise — Fool's Wisdom — Say "I Do" — Why Me Lord? — Tell It To Jesus — Cast Your Care — Morning Has Broken — Come With Me — Now And Then — And This Is Love — Day By Day (Amazing Grace) — Didn't He?

The sound on this fully imported pressing is very clean and it may provide you with the opportunity to demonstrate to the kids that your "mature" tastes can run to something more modern! Well worth a hearing. (W.N.W.)

★ ★ ★

THE NEW ORLEANS SALVATION AND MARCHING BAND. Stereo, Lamb & Lion LL-1010. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals.

The mood is set for this record by the name and by the picture of seven Dixieland bandsmen astride the rail tracks. And, predictably, the program opens with a traditional Dixieland version of "When The Saints". On side 2 Joshua "Fits The Battle of Jericho" and these are probably the most successful numbers. Some of the slower ones like "Known Only To Him" are a bit of a struggle and the sound is more akin to what the jacket refers to as a (New Orleans) "church band giving a street corner concert . . ."

The other titles include: A Beautiful Life — Old Gospel Ship — Farther Along — Will The Circle Be Unbroken? — This Train — Walking Close To Jesus — Canaan's Land — Just A Closer Walk With Thee.

As Dixieland music I wouldn't expect it to set the world on fire but the album is notable for being a deliberate devotional release in Dixieland style, as distinct from a Dixieland performance which happens to include devotional titles. Or am I splitting straws? Either way, you'll need to make up your own mind on this one. (W.N.W.)

Instrumental, Vocal and Humour

FESTIVE MARCHES. Various Orchestras and conductors. Stereo, Deutsche Grammophon 2538-264.

One of several "Festival of Hits" series, the items on this release are taken from other D.G. albums so that, in effect, it is something of a sampler. The fifteen "Festive" marches here (nothing solemn or funereal) are all well known, about half of them from opera or stage presentations: March from "Oberon" (Weber) — From "The Marriage Of Figaro" (Mozart) — Op. 99 (Prokofiev) — From "Fidelio" (Beethoven) — Soldiers' Chorus "Il Trovatore" (Verdi) — From Serenade No 6 (Mozart) — Entrance Of The Guests "Tannhauser" (Wagner) — Radetzky March (J. Strauss) — Soldiers' Chorus "Damnation Of Faust" (Berlioz) — Persian March (J. Struss) — Concert Piece in F Minor (Weber) — Turkish March "The Ruins Of Athens" (Beethoven) — From "Don Carlos" (Verdi) — Hungarian March "Damnation Of Faust" (Berlioz) — The Bear Went Over The Mountain "Wellington's Victory" (Beethoven).

The quality is well balanced and clean and, to be helpful, the jacket notes briefly give the setting of each extract. Varied and cheerful snippets. (W.N.W.)

★ ★ ★

PERMISSIVE POLYPHONICS. Enoch Light and the Light Brigade. Quadraphonic, Project 3 (Festival) SPJL-933969.

Enoch Light and his Brigade are out in force for this serving of "Escapism through the turned-on sounds of today". To quote the jacket notes further: "Every explosive advance in modern arranging and modern instrumentation has been explored in this fascinating album". At least that's been Enoch Light's objective, with resources ranging from chorus to Moog Synthesiser, traditional instruments to various electrified this's and thats! Occasionally they aim for total sound bit, for the most part, the aim is to feature individual instruments or groups. It's lively but not heavy sound.

In the tracks: Marrakesh Express — Let It Be — Easy Come, Easy Go — Puppet Man — Prelude For Young Lovers — It Was A Very Good Year — Masque Nada — Monday, Monday — Sittin' On The Dock Of The Bay — Scarborough Fair — Michelle — Pass And I'll Call You.

The quality and 4-channel spread are normal and if the numbers appeal Enoch Light won't let you down. (W.N.W.)

★ ★ ★

BREAKTHROUGH. Louie Bellson. Quadraphonic, Project 3 (Festival) PJL-33,113Q.

The cover lines of this album read: "Enoch Light presents Louie Bellson. Sonic sounds of tomorrow. The electronic excitement of today's music Breakthrough".

Reviews in this section are by Neville Williams (W.N.W.), Harry Tyrer (H.A.T.), Leo Simpson (L.D.S.), Gil Wahlquist (G.W.), and Norman Marks (N.J.M.).

Individuals may react in at least three ways to the album, singly or collectively:

1. One that bears the imprimatur of Enoch Light — highly original arrangements, lots of instrumental colour; sound that compels your attention so that you either become involved or resent its intrusion.

2. A show piece for the Louie Bellson big band, with a concentration of technical interest on the arrangements, the featured instrumentalists including Louie Bellson himself, and the use of electronic supplements to conventional instruments. This, together with jacket notes for this kind of listener.

3. The very clean sound and the most impressive exploitation of the rear channels to complement what is going on out front. Most impressive separation.

The tracks: I Remember Bird — Shuffle Off To Broadway — The Eel — 3 x 5 + 16 — Ode To Billy Joe — My Very Own Person — Breakthrough — The Moment Of Truth — The Look Of Love — Just Like That.

Not slumber music but interesting for the above reasons. Stop and have a listen. (W.N.W.)

★ ★ ★

FAMILIAR SONGS FROM FOREIGN LANDS. Enoch Light and His Orchestras. Stereo, Command (EMI) "Two Up" 2-record album RSSD-105-1/2.

Addressing myself to the typewriter, the other evening, I put the first of these two discs on the turntable, with the amplifier turned down low and set for quadraphonic decode. Believe it or not what emerged was some very pleasant "surround" background music. Yes, Enoch Light, the architect of sonic spectacle, producing background music!

I suspect it may not have been intentional, but rather the result of someone at Command going through the huge mass of Enoch Light recordings and assembling twenty in which the emphasis happened to be on music of the sweeter kind. And, true to the title, the music is thematic and well known. Here are just a few of the titles:

Gloca Morra — Third Man Theme — Brazil — Waltzing Matilda — Istanbul — Flying Down To Rio — Exodus Theme — Cielito Lindo — Vienna Woods — Isle Of Capri — Poor People Of Paris — Besame Mucho — Colonel Bogey.

No, it's not dull and you can turn it up as loudly as you like. But try it as background; you'll like it. (W.N.W.)

★ ★ ★

THE WORLD OF RACHMANINOV. Various artists and orchestras. Stereo, Decca World of the Great Classics Series SPA.310.

"Bits-and-pieces" discs such as these, containing isolated movements from major works, have no real place in serious collections, but they serve a useful purpose in introducing a composer to those who have not yet gained anything but a superficial knowledge of that composer's works. This selection begins and ends with movements from the popular Second Piano Concerto from a Russian recording featuring the now famous Ashkenazy, who also plays the finale from the third Piano Concerto with the London Symphony under Boult. These are the highlights of the disc, with excellent playing and good quality recordings.

The inevitable C sharp minor Prelude is played in piano duet version, and once popular Moura Lympany plays the far more interesting "Militaire" Prelude, in an old recording reprocessed from mono. Just as inevitable is the 18th variation from the Paganini Rhapsody, accompanied here by the 16th and 17th variations. The program is completed by movements from the 1st and 2nd Symphonies. If you have not yet added Rachmaninov to your listening repertoire, this budget price disc is worth a try. (H.A.T.)

★ ★ ★

THE CHARM OF OLD VIENNA. The Willi Boskowsky Ensemble. Stereo, Vanguard (Astor) VSD 727/28. Two disc set in folding sleeve.

This is a really splendid set, consisting of music by the two J. Strausses, Mozart, Schubert, Haydn, Lanner and a few lesser lights. What makes these tracks particularly interesting is that they are played by small instrumental ensembles (in some cases as few as three performers) such as would have performed in Viennese hostelries, cafes and beer gardens in the past. And if you think that two violins and a double bass are unable to do justice to Strauss, listen to the Keckenbrucker Waltz as played here. Larger ensembles, including both wind and string instruments, are used where required. Under the guidance of the indefatigable Willi Boskowsky, they present first class entertainment.

The music throughout is exclusively for dancing — Waltzes, Galops, Contredanses, Landler, Zingarese (gypsy dances), Polkas . . . too many to list by titles. Take my word for it that it is all delightfully tuneful, and when played by experts, as here, it will not fail to please the most critical listener. The recording is also first class, a worthy product of modern recording technology. (H.A.T.)

★ ★ ★

GREAT MOVIE STARS OF THE 30's. All Talking. All Singing. All Dancing. Mono, EMI OXLP-7542.

As a callow youth I regarded Bebe Daniels as the ultimate in desirable femininity and Adolphe Menjou as the man I least liked to watch on the silent screen. As revealed on this early record, Bebe Daniels would scarcely make the village Eisteddfod, while Adolphe Menjou's singing voice is worse than mine — and that's saying something! And as for Ramon Novarro. . . .

George Burns and Gracie Allen come off better, but even Jeanette McDonald sounds very ordinary in the unenterprising style and sound of the early thirties. Oh yes, there's Gloria Swanson and Tallulah Bankhead.

Maurice Chevalier dominates side 2 but, in fairness, he has the Jack Hylton orchestra to brighten things up. The remainder of side 2 features Pola Negri, Rudy Vallee, Frances Langford, Bebe Daniels and Ben Lyon, Lilli Palmer and Walter Pidgeon.

The jacket notes invite the listener to classify the individual performances as "great" or "high camp" and that about sums it up. Certainly the names, the sounds and the jacket notes add up to a large helping of nostalgia: good, bad and indifferent. One thing I must admit, the sound is a bit muffled, but it's clean and free from background noises. (W.N.W.)

★ ★ ★

VALSES Y POLKAS, JUAN MARQUEZ. HISPAVOX L35214 Festival Release.

A most unusual coupling of large "straight" orchestra with guitars and percussion gives a very fresh sound to a group of best known waltzes and polkas, the sound is very spacious and clean, with the guitars and drums being rather forward. The eight titles are: Tritsch-Trasch Polka — Emperor Waltz — Pizzicato Polka — Blue Danube — Radetzky March — Vienna Blood — Annen Polka — Vienna Woods.

The overall effect might not be to a purist's taste but give the disc a hearing, I found it really enjoyable, at least nobody will go to sleep through it. (N.J.M.)

★ ★ ★

BIG BAND HITS. Vol 2. The 101 Strings Orchestra. Alshire (Astor) S-5305.

In some of their recordings the 101 Strings might reasonably have been accused of producing what I heard described recently as "wallpaper music" . . the type that is

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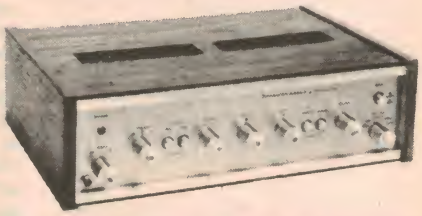

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VARIETY FARE

meant to surround you as you do the household chores! While there are times when I rather like the "wallpaper" variety, this album is rather more positive in character, though still from the 101-String mould.

The Big Band Hits include: I'll Never Smile Again — Begin The Beguine — Moonlight Serenade — Cherry Pink And Apple Blossom White — I've Got My Love To Keep Me Warm — Chopsticks — Down By The Old Mill Stream — Suddenly It's Spring — Indigo Dream — Fancy That.

Pleasant middle-of-the-road sound, cleanly recorded. (W.N.W.)

★ ★ ★

GEORGE MARKEY PLAYS THE ALLEN DIGITAL COMPUTER ORGAN. LP-2103. Allen Organ Company.

This is a more recent release in a series of recordings produced by the Allen Organ Company. Regular readers of these columns will no doubt recall reviews of earlier releases some months ago. At that time, all our reviewers were unanimous in their praise of the Allen organ with its convincing pipe organ sound. This recording is no exception in this regard.

The organ used for this recording is installed at the Trinity Lutheran Church in Davenport, Iowa. Dr George Markey, Director of the Guilmant Choir College at Princeton, New Jersey, is one of America's leading organists.

Side 1 includes — Prelude & Fugue in C Major, by J. S. Bach — Chorale "Was Gott Tut, Das Ist Wohlgetan", by Johann Peter Kellner — Sonata De Primo Tono; Sonata on Toné 1, by Jose Lidon — Concerto in B Flat, by William Felton. On Side 2 — Pastorale, by Jean Roger-Ducasse, Chorale Improvisation Sur Le "Victimae Paschali", by Charles Tournemire.

A delightful program which I can recommend to lovers of serious organ music. Copies may be obtained by post, from Allen Digital Computer Organ Studios (Aust.), 32 Woodhouse Road, Doncaster East, Victoria 3109. Price $5.00. (I.L.P.)

★ ★ ★

LAWRENCE WELK PLAYS HIS FAVOURITES FROM, THAT'S ENTERTAINMENT. INTERFUSION Stereo L25154 Festival release.

If you are old enough to remember the days of the lavish Hollywood musical, particularly those from the MGM Studios, you will surely enjoy this big-band treatment of ten of the really big hits going back to "A pretty girl is like a melody" from "The Great Ziegfeld" of 1936. Each number is given the right treatment, Honky Tonk, Dixieland, big band or smooth instrumental. The other titles are: Be My Love — Pagan Love Song — I Guess I'll Have To Change My Plan — Varsity Drag — Gigi — Thou Swell — Ol' Man River — Begin the Beguine — Honeysuckle Rose — Make Believe. At $3.99 it is an economy way to sooth your nostalgia nerve, and the quality is good. (N.J.M.)

★ ★ ★

HONKY TONK ANGEL. Conway Twitty. MCA stereo MAPS 7299.

Twitty seems as unlikely a name that you could think for a Country and Western style singer but C & W fans know him well. He sings in a good straight style and the songs on this disc suit him well. Quality is good.

Eleven tracks are featured: There's A Honky Tonk Angel — Pop A Top — Somewnere Just Out Of Her Mind — Making Plans — Don't Let It Go To Her Heart — A Bad Seed My Daddy Sowed — Before Your Time — Love Is The Foundation — Pick Me Up On Your Way Down — Amazing Love — A Simple Country Girl. (L.D.S.)

CARNIVAL OF SPAIN. Various Orchestras and the 101 Strings. Stereo 3-record Boxed Set, Alshire (Astor) ASF-505.

Without speculating as to the identity of the "various orchestras", the prominent mention of "101 Strings" gives the clue to the nature of the music on this 3-record set —tuneful, easy on the ear, and with massed strings providing the basic musical backdrop.

And, of course, most of the tunes are popular favourites with a Spanish association of one kind or another. To quote a few: The Breeze And I — Maria Elena — Spanish Eyes — Granada — Malaguena — Rancho Grande — Spanish Candle — La Negra — You Belong To My Heart — Be Mine Tonight — Espana — Matador — Valencia — Espana Cani.

I didn't play and time every track on the six sides but they would add up to about 100 minutes of music, or two 50-minute segments if you are using a record changer. The sound quality is clean — perhaps deliberately a little light in the bass — but well suited to provide a pleasant background to a meal or the evening paper. (W.N.W.)

VARIETY FARE

Three records from the Academy of St Martin -in-the-Fields.

WOLFGANG AMADEUS MOZART. Early Symphonies, Symphony in D, Kershel No 19; Symphony in B flat, K22; Symphony in D, K81; Symphony in E flat, K16; Symphony in G, K74. Academy of St Martin-in-the-Fields, directed by Neville Marriner. Stereo, Philips 6500 352.

WOLFGANG AMADEUS MOZART. Flute Concerto in G, K313; Oboe Concerton inC, K314. Academy of St Martin-in-the-Fields, directed by Neville Marriner. Claude Monteux, flute; Neil Black, oboe. Philips stereo 6500 379.

WOLFGANG AMADEUS MOZART. Concerto for Clarinet and Orchestra in A, K622; Concerto for Bassoon and Orchestra in B flat, K19; Andante for Flute and Orchestra in C, K315. Academy of St Martin-in-the-Fields, directed by Neville Marriner. Jack Brymer, clarinet; Michael Chapman, bassoon; Claude Monteux, flute. Philips stereo 6500 378.

Make no mistake, these are three very fine albums. They were released to coincide with the Australian visit of the world-famous Academy of St Martin-in-the-Fields in October. You need a high quality music system to really appreciate the very high recording standards attained but even if you have a modest system you should try and obtain at least one of these albums.

While we are only reviewing three records here several others have been recently released by the Academy. I have heard some of these and on casual listening, they are equally as good as those listed above. If your budget is limited, at least try and get one of the latter two albums shown above, although the "Early symphonies" are also very attractive.

Combine the high recording standards with the excellent string tone obtained from the Orchestra by director Neville Marriner, together with the overall precision of playing and you have records that others will be judged by for quite some time to come. (L.D.S.)

LLOYD GREEN. SHADES OF STEEL. MONUMENT L35144 Stereo Festival Release.

The steel guitar featured on this record is the flat-bed type where the musician sits down to play, with a singing tone somewhat reminiscent of the Hawaiian style of playing popular some years ago. The backing is well listed on the sleeve, ranging from electric piano and guitars, Moog, bass, to almost a dozen strings, the whole producing a most enjoyable, relaxing sound. The titles: I Can See Clearly Now — Killing Me Softly With Her Song — Jambalaya — Morning Has Broken — Dixie Drive-in — Atlantis — Here Comes The Sun — Sleep Walk — Danny's Song — Peace — Steel Guitar Rag — Summer Clouds.

The quality enhances an enjoyable recording. (N.J.M.)

★ ★ ★

THE VENTURES PLAY THE CARPENTERS. UNITED ARTISTS L35238 Stereo Festival Release.

Unless you're out of touch with records or radio you surely are familiar with the Carpenters and their many vocal successes, particularly their big hit, Close To You.

In this record we hear an enjoyable instrumental version from the Ventures that should have the same sort of popularity as the vocal original, with the main theme carried by guittars. The twelve titles are: We've Only Just Begun — Yesterday Once More — It's Going To Take Some Time — Bless The Beasts And Children — Top Of The World — Sing — Superstar — Close To You — Hurting Each Other — Rainy Days And Mondays — Jambalaya — Goodbye To Love. The quality is really great with good use of stereo without being gimmicky. (N.J.M.)

YOUNG TALENT TIME HITS, Vol 4 Featuring Johnny Young & The Young Talent Team. L&Y Records L25155 Festival Release.

The entertainment industry should never run out of future stars as long as youthful performers such as these keep coming along with their fresh voices on such numbers as: He's A Rebel — Holiday — Mare Mare Mare — Impossible Dream — If I Could Write A Song — Milly-Molly Mandy — Hello Funny Face — Over The Rainbow — Put Your Head On My Shoulder — You Won't Find Another Fool Like Me — Sky Diver — Another One Of Those Songs. If you are an ardent fan of the TV show you can put this on your shopping list, at $3.99 it's a bargain. The quality is really good. (N.J.M.)

★ ★ ★

BURT BACHARACH, PORTRAIT IN MUSIC. A&M RECORDS L 35271 Festival Release.

I doubt if there is anyone not familiar with the hits that flow from the team of Bacharach and David and this very enjoyable record gives ample reasons for the popularity. All the tracks are given the full orchestral treatment and with the excellent sound quality make it the ideal disc for dining background or as a present for that hard to please friend. The tracks are: Come Touch The Sun — The Windows Of The World — April Fools — Freefall — The Old Fun City — Pacific Coast Highway — Not Goin' Home Anymore — She's Gone Away — Are You There — Bond Street — Message To Michael — Knowing When To Leave — Nikki — And The People Were With Her. (N.J.M.).

New Products

2-Metre transceiver from Dick Smith

The growing availability of compact imported solid-state FM transceivers designed for the amateur 2-metre band reflects the popularity of this mode and band for mobile operation. The Icom IC-22 is a very attractive transceiver, representative of the best currently available. We had the opportunity to test a sample unit recently, supplied by Dick Smith Wholesale Pty Ltd.

The Icom IC-22 FM transceiver is made by Inoue Communication Equipment Corporation of Japan. It measures 5.8cm high, 15.5cm wide, 21.6cm deep, and weighs only 1.8kg. It comes complete with all hardware for mounting in a vehicle, including a latching clamp to permit easy removal. Apart from unlatching this clamp, it is only necessary to unplug the aerial and power supply leads to complete the job.

The transmitter has two RF power output ratings; 1W and 10W. It uses an 18MHz crystal multiplied 8 times and, as supplied, has adjustable frequency deviation from 3 to 16kHz (plus and minus 8kHz). It is supplied with an attractive dynamic microphone with press-to-talk switch.

The receiver is a double superhet, using 10.7MHz 1st IF and 455kHz 2nd IF. Its sensitivity is quoted as better than 0.4uV for 20dB quieting, and the bandwidth is given as 6dB down at plus or minus 8kHz and 50dB down at plus or minus 15kHz. Audio output is 1.5W.

The receiver uses two crystals; one each for the first and second mixers. The one controlling the first mixer may be changed to select the required channel. The one for the second mixer functions for all channels.

The complete transceiver uses 23 transistors, 3 FETs, 3ICs, and 16 diodes. It has provision for no less than 22 crystal controlled channels, selected by a front panel knob with illuminated channel selector. A meter on the front panel functions as an "S" meter for reception and an RF indicator for transmission.

Other front panel controls are volume, squelch, and a three position switch giving the two choices of RF power and "off". On the rear panel is the aerial socket, an external speaker jack, and an accessory socket. The latter provides access to the discriminator circuit to permit crystal trimmer adjustment. A fused power cord, with plug, also emerges from the rear panel.

The unit is normally supplied in two models; one covering 144 to 146MHz, the other from 146 to 148MHz. Since neither of these models would suit the Australian 2 metre scene, which straddles 146MHz, Dick Smith has organised a special model covering from 145 to 147MHz. He warns intending buyers that they should check this point carefully before investing in one of these units.

Power consumption is given as 180mA on receiver standby, 1.2A on 1W transmission, and 2.1A on 10W transmission.

The whole unit is constructed on a single printed board, for ease of service. No relays are used, an electronic network being used as the aerial changeover device.

An important point to appreciate with any imported FM equipment is that amateur VHF channels in Japan and USA are almost exclusively narrow band, ie, plus and minus 7.5kHz (15kHz overall). This is undoubtedly due to the large number of amateurs, using a limited band allocation.

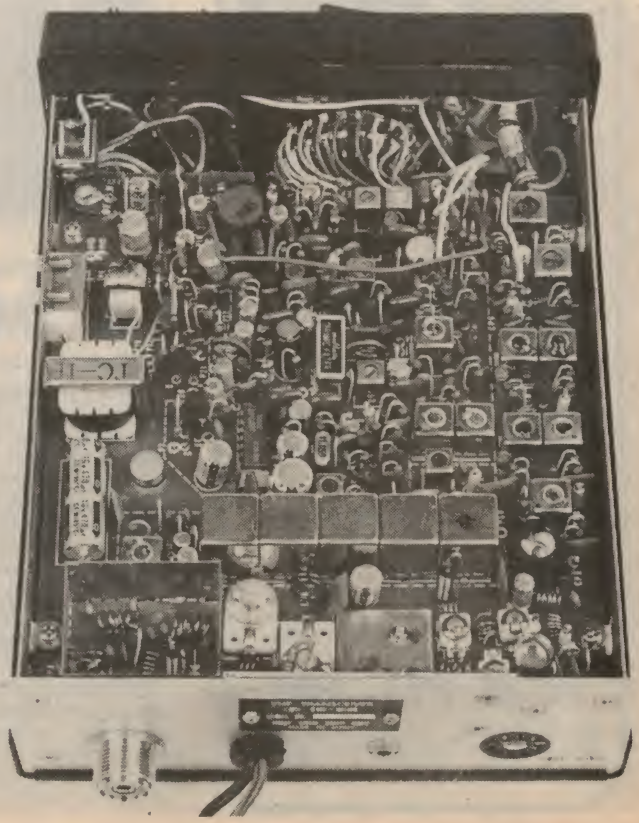
Australian amateurs, on the other hand, have favoured and been able to use wider bandwidths. This is a legacy from the disposals mobile units with which the net channels were started, and which were available for the very reason that they were occupying too much space on the commercial bands. Most were 30kHz overall, some 60kHz or more.

In such an environment, any narrow band equipment tends to be at a disadvantage. A narrow band transmitter does not exploit the full bandwidth of the receiver and, as a result, the noise level will be up, while the recovered audio will be down. On the other hand, a narrow band receiver will distort quite noticeably when receiving wide band transmissions.

In practice, this is not as serious a problem as the foregoing might imply; certainly not serious enough to deter the would-be purchaser if all other features are to his liking. But it should be appreciated if the equipment is to be given a fair assessment.

In any case, a study of the circuit reveals that the transmitter, at least, has been designed for two orders of deviation. The audio transformer following the deviation control is connected to the latter via a flying lead and miniature female connector, which may be connected to either one of two pins on the printed board. One pin provides a "straight through" connection, the other introduces a voltage divider. (Approximately 3 to 1, or 10dB). The unit is normally supplied set to the narrower position. Changing the lead is a simple operation, while there is also a "mic gain control" and "deviation control" which may be advanced if necessary.

The unit supplied to us was fitted with one set of crystals for the 146MHz net channel. We took it home and, over a couple of weekends, gave it a workout on the bench. The only aerial available was a simple coaxial dipole, fed with 75 ohm cable. This was not an ideal situation, since the unit is



The IC-22 with cover removed, showing the neat and compact layout of the printed board. In general, the receiver section is on the right and the transmitter on the left. The heat sink for the final stage is at the bottom of the picture, slightly right of centre. The "mic" and "deviation" controls, plus the deviation tappings mentioned in the text, are in the top left corner. The channel selector switch is behind the centre of the front panel. The instruction manual contains a circuit and printed board pattern.

Low cost portable from Classic Radio

One of the dramatic effects of the recent reduction in tariffs was the appearance on the Australian market of cheap miniature transistor radios, made in places like Hong Kong and Taiwan. They are being sold for a few dollars each and have even been given away free by some stores as promotional gimmicks.

While most such receivers have been superhets, the cheapest of them have often performed indifferently in terms of gain, sound output and in their ability to cope with strong signals. Nor has there been any thought of servicing; if they failed, they would normally be discarded.

On a recent trip to Hong Kong, Jack Lewis of Classic Radio picked over the sets offering and selected the "Genesonic" receiver, illustrated, as one that seemed a cut above others in its price class.

A 6-transistor superhet, it is built on a printed wiring board which can be removed easily from the case for service access. This fact, along with the availability of spare parts from Classic Radio makes servicing a proposition — provided it can be carried out for less than the cost of a complete new receiver!

Actual cost of the Genesonic receiver is $6.95 direct from Classic Radio at 245 Parramatta Rd, Haberfield NSW 2045. For mail order, add 90c to cover package and post. The receiver measures approx 110 x 70 x 33mm and comes in a carton complete with handstrap, earphone, and two 1.5 penlight cells.

At left is the Genesonic "Solid State 10" receiver, while above is a view inside the case.

A couple of receivers checked by E.A. staff performed well in typical Sydney areas, with ample selectivity to separate all the local stations, no obvious AGC problems and sensitivity to bring in a fair selection of country and interstate transmitters at night.

Performance, in short, is up to the usual expectations of a miniature 6 transistor superhet, and adequate for personal listening in all ordinary urban and provincial areas. (W.N.W.)

Philips LF generator

The PM5106 LF generator is a recent addition to the Philips range. With a frequency range of 10Hz to 100kHz, it offers sine or square wave outputs with very low output impedance: 10 ohms. Sinewave output is 10V RMS output maximum, with output flat within 0.2dB and typical distortion of less than 0.8pc. Square wave output is 20V P-P maximum, constant within .05dB and with less than 0.3 microseconds risetime.

Frequency selection is via a 10:1 range dial with four range buttons. Output amplitude is via a continuous control and an "x.01" step attenuator switch.

Philips believe the new instrument should be of particular value in educational and training applications.

Icom 2M transceiver — cont.

designed for a 50 ohm aerial.

One's first reaction is that the maker's receiver figures appear to be fully justified. In spite of a poor location, excellent signals were received from mobiles in remote — and in some cases similarly poor—locations in the metropolitan area. The squelch circuit works well and the audio quality is excellent. We imagine that, coupled to a beam, this receiver would really sing.

A power output measurement into a dummy load fully supports the makers figures of 1 watt and 10 watts output for the "low" and "high" positions respectively.

We experienced some cases of distortion due to deviations beyond the receiver's bandwidth, but none which impaired readability. Some — but not all — reports commented on reduced deviation. Subsequently we wound up the two controls and shifted the previously mentioned tapping to the wide position. Local tests (into another receiver) and reports confirmed that this is very well worth while, assuming the other receiver is wide band.

As well as mobile and bench operation, the unit would lend itself to pack set operation. It would not be difficult to fabricate a case to carry the unit, a set of portable batteries, and to support a simple whip antenna.

Our overall impression is that this is a particularly attractive unit, and very good value at the price quoted.

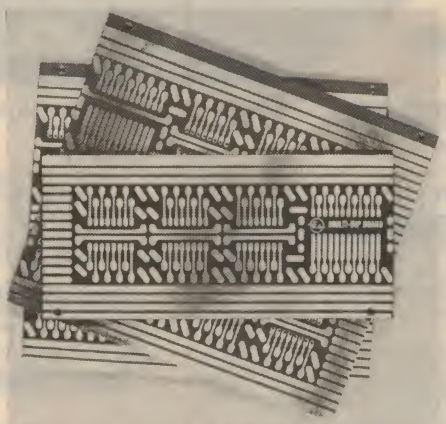
Price, including tax and fitted with one set of crystals, is $189.00. Additional crystals are available for all Australian net and repeater channels. Spare parts will be available for those doing their own service, or full service for those who require it. (P.G.W.)

Multi-DIP board lowers cost of one-off projects using ICs

Making a custom PC board for a new one-off project you've designed using ICs can be a real challenge. Some enthusiasts find it very rewarding, and after the breadboard stage take delight in planning the PC pattern, producing their artwork and etching a board. But to others, this can be a chore; they would just as soon have a fast way of getting the project built up, so that they can get on with something else.

Quite apart from whether you enjoy it or not, making custom PC boards for one-off projects is not very economic. It involves a lot of time and effort, and for a design which is only going to be built once or twice, this is hard to justify.

Just try to have a single custom board made for you commercially, and you'll find out how costly it can be.



Of course there are "universal" PC boards available, designed to permit easy and rapid wiring up for any custom circuit. These are probably just fine for small manufacturing runs and one-off applications in research and industry, but they have many drilled holes and generally quite a complex pattern. This tends to make them too costly for use in hobby situations.

With this in mind, the staff of E-A, in conjunction with RCS Radio Pty Ltd, has come up with a new low-cost "universal" board design which we hope will fill the bill. Based on our earlier single-IC "DIP-board", it in effect consists of a number of these boards combined.

As shown in the picture, there are actually two versions of the board — a full version, and a half-size version. The full version has provision for up to 8 14-pin or 16-pin DIL devices, or 6 such devices together with two 18-pin or 24-pin devices. The latter devices may have either 0.3in or 0.6in spacing.

For applications where the full board would be too big, you will be able to buy the half-size version, with space for either four 14-pin or 16-pin devices, or three of these together with a single 18-pin or 24-pin device.

Because hole drilling adds considerably to the cost of PC boards, we have arranged that like the earlier DIP board, the new "Multi-DIP" boards will be supplied undrilled. However the positions of the IC pins will be etched in the pattern, so constructors can drill them out themselves if they desire. This way, if you want to wire up a design with the ICs and other components on the copper side, you won't have to pay for holes you don't need.

Alternatively, you can drill out the holes and mount the ICs on the "top" side quite easily, if you wish.

In this way, we believe we have come up with just about the cheapest possible universal PC board, yet one which is very practical.

The boards are etched from SRBP laminate, and can be made to plug into edge connector sockets — 32-way or 16-way respectively.

Enquiries regarding price and availablility of the new Multi-DIP boards should be directed to RCS Radio Pty Ltd, 651 Forest Rd, Bexley, NSW. (J.R.)

NEW PRODUCTS

Kodak offers new cassette recorder with inbuilt slide sync

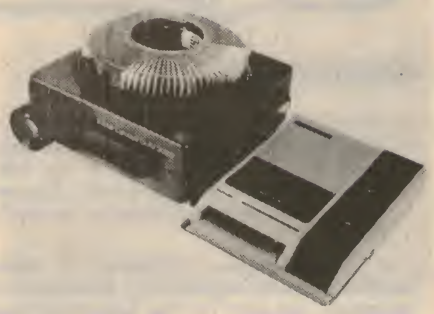
Kodak has announced the availability in Australia of a cassette recorder specially designed for synchronising colour slides with sound.

Called the Hitachi Audio Adapter AVA 1200, the recorder is unique in that it incorporates many features which make it a most flexible piece of equipment. Not only is the AVA 1200 an excellent cassette recorder with very good sound reproduction, but also a slide synchroniser and public address amplifier.

Features include two different methods of slide synchronisation. Method 1 is the standard 1000 Hz slide advance cue, and a 150 Hz tape stop pulse on a separate track from the narration. The stop pulse is ideal for student response situations. Method 2 is a 50 Hz slide advance cue which is recorded on the same track as the narration. The pulse is inaudible.

As soon as the AVA 1200 is plugged into the power supply it becomes a public address sytem. With an extension speaker the 2½-watt output gives enough sound for any meeting room or class-room. There is a separate volume control for this PA system.

Other facilities include a large VU meter, digital counter, tone control, and a monitor or earphone socket. Inputs can be through



DIN, radio or microphone sockets.

The weight is only 2,5 Kg (5½ lbs.). There is a convenient pushbutton system for precise and speedy operation.

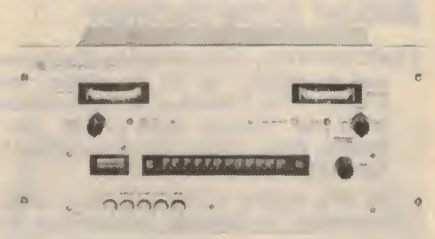
The audio adapter has an auto shut-off mechanism when the tape is finished. Solid state, transistorised circuitry (including 8 IC's) assures outstanding reliability and constant top-level performance.

Accessories included are a dynamic microphone with remote-control switch, microphone stand, AC power cord, cassette tape (C-30), carrying case and cassette recorder-projector cable.

AWA broadcast monitor receiver

The AWA Broadcast Monitor Receiver, BMR-1, is designed to monitor "off air" transmissions from broadcast stations in the 525 to 1605 kHz band. Monitoring functions provided by the receiver include meters indicating carrier and modulation; carrier failure and programme failure alarms; audio output for driving external amplifiers and recorders.

The receiver comprises a single unit for rack-mounting, and is fully solid-state. It contains three basic parts — a manually-operated tuner, providing all normal receiver functions up to the audio output, including a 10kHz whistle filter; a monitor section to operate the monitor and alarm circuits; and a regulated power supply operating from nominal 240V 50 Hz mains.



Sets of studio extension meters are available to operate from the receiver.

Further information is available from Amalgamated Wireless (Australasia) Ltd Engineering Products Division, 422 Lane Cove Road, NSW 2113.

Books & Literature

Dictionary

DICTIONARY OF ELECTRICAL ENGINEERING, by K. G. Jackson. Published by Butterworth & Co Ltd, London, 1973. Hard covers, 143 x 223mm, 375pp, with diagrams. Price in Australia $7.50.

A comprehensive dictionary of terms used in electrical engineering, intended as a reference not only for the apprentice and student, but also for the practising engineer. It is mainly concerned with power engineering, control and lighting, but there are a reasonable number of terms from electronics as well.

It is basically a revised, expanded and updated version of the Concise Encyclopaedia of Electrical Engineering, published by Newnes in 1965.

For those involved in electrical engineering as well as electronics, it would be a worthwhile addition to the reference shelf.

The review copy came from the local office of the publisher, but copies should be available at all major and technical bookstores (J.R.)

Broad introduction

ELECTRONICS, A Handbook for Engineers and Scientists, by G. H. Olsen. 2nd Edition, 1974. Published by Butterworth & Co Ltd, London. Hard covers, 160 x 225mm, 482pp, many diagrams. Price in Australia $19.00.

The first edition of this book was called "Electronics: A General Introduction for the Non-Specialist", and this would still be appropriate. Essentially it is a broad introduction to the subject, intended particularly for people in the many fields of science and technology which use electronic equipment in measurement, monitoring and control.

There are ten chapters, whose headings give a fairly clear indication of the scope and order of treatment: 1 — Introduction; 2 — Passive components: resistors, capacitors and inductors; 3 — The response of circuits containing passive components; 4 — Semiconductor devices; 5 — Indicating instruments; 6 — Power supplies; 7 — Amplifiers; 8 — Oscillators; 9 — Introduction to logic and digital circuits; 10 — Miscellaneous measuring instruments. The book ends with five data appendices.

As you may have noticed from this, there is no mention of the thermionic valve. The author notes that all material dealing with valves in the first edition has been deleted, to make room for additional material on solid state devices, and in particular monolithic ICs. This seems reasonable, in vew of the type of reader for whom the book is intended.

The book is deliberately non-formal in its approach, yet gives sufficient basic theory to satisfy those wanting more than just a superficial treatment. At the same time it is well laced with practical applications and circuits. This together with its up-to-date content should make it of great value as a laboratory reference book.

The text is written in clear and concise language, is very readable, and is well served by diagrams and circuits.

In short, a book which seems to achieve its author's stated aims commendably well. It should be found particularly valuable as an introductory text not only by non-electronic engineers and scientists, but by students, amateurs and advanced hobbyists as well.

The review copy came from the Australian office of the publisher, but copies should be in stock at all major and technical bookstores. (J.R.)

And another . . .

HOW TO BUILD AND USE ELECTRONIC DEVICES WITHOUT FRUSTRATION, PANIC, MOUNTAINS OF MONEY, OR AN ENGINEERING DEGREE, by Stuart A. Hoenig and F. Leland Payne. Published by Little, Brown and Co, Boston, 1973. Soft covers, 155 x 233mm, 360pp, many circuits and diagrams. Price in Australia $11.95.

This is rather like the book by Olsen, in that it has been written specifically for graduate students, scientists and other non-electronic folk, who need to use electronic equipment with confidence, yet at the same time don't want to worry about deep theory. As the long title suggests, it takes an even more practical slant than the Olsen book, with bits of humour thrown in as well to make the going more pleasant.

The basic emphasis is on that wonder animal of the 60's and 70's, the op amp, which the authors present as something only a little short of the universal panacea. And after reading through the book lightly, I am certainly inclined to agree that, for the type of reader the book is aimed at, the op amp probably isn't far short of a universal panacea.

In fact I thought I had a fair idea of the applications of op amps, but there were many given by Hoenig and Payne that I hadn't even imagined. This suggests that many of us who regard ourselves as part of the "in"' group of electronics would also find the book of value and interest.

Like the title itself, the chapter headings are wordy, but they give a good idea of the general approach: 1 — A little circuit theory and an instrument or two; 2 — The op-amp and how to make it work for you; 3 — Op-amp applications for fun and profit; 4 — Biomedical applications of op-amp circuits; 5 — The op-amp as an analog computer; 6 — Op-amp problems and how to fix them; 7 — Discrete devices (if you must use them); 8 — Conclusions.

There are also a number of appendices, two of which give books for further reading and a glossary of terms.

Throughout the text, the emphasis is on fast assimilation of sufficient knowledge to produce practical results. The authors state that they have based this on the "monkey see, monkey do" technique used in World War 2 to teach farm boys to be sailors in a few weeks.

Their justification for using this idea with the present book is that with modern electronics, the "quick and dirty" method is often the most practical. Waiting until you are able to come up with the "best" design usually means that the design will be obsolete by the time you get it going, and the job for which it was needed will have long since disappeared. This has a lot of validity nowadays.

Before I end up, I must quote the mnemonic which the authors give as a way of remembering the resistor colour code. It is new to me, and emphasises the humour used to leaven the book: Bad Boys Rape Our Young Girls But Violet Gives Willingly(!)

All in all, a refreshingly honest book, and one which should be of great practical value not only to researchers wanting to knock up op-amp circuits "before afternoon tea", but for almost anyone in electronics as well.

The review copy came from Ramsay Surgical Ltd, who have offices in all states. (J.R.)

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The Amateur Bands

by Pierce Healy, VK2APQ

Amateur radio clubs

The gregarious instinct brings together those who share a common interest. In amateur radio, this trait has produced a unique fellowship which spreads from small localised groups to a world wide international organisation.

No activity, religious, political or ideological, has achieved such widespread participation as amateur radio. Yet within the ranks of amateur radio are people of many nationalities and creeds. The reason is a desire to communicate with and learn about those living in parts of the world which we cannot expect to visit.

From the desire to converse with each other has grown the willingness to assist others to further their knowledge and ability. No other groups have, through individual or collective efforts, contributed so much to the advancement of communication and entertainment. Often the contributions crystallised from discussions in radio clubs.

In Australia, as elsewhere, amateurs have played a major role in the establishment of broadcasting services, international, national, aircraft and mobile communication services. In addition, assistance given in all parts of the world by providing communication during natural disasters is legendary.

However, the irony is that, through the ever increasing demands for commercial and governmental radio channels, amateurs have had to fight to share the natural resource which makes radio communication possible. A resource which knows no boundaries, cannot be manufactured, stored or destroyed by man. Unfortunately, it can be polluted and is often misused.

The oldest established amateur radio organisation in the world is the Wireless Institute of Australia, formed in 1911. Today, in any part of the world, a welcome awaits the radio amateur, either by an individual operator, a local club or a national group.

Such is the amateur radio club phenomenon!

Following many requests about radio clubs in Australia, from those travelling or wishing to join a club, an invitation was extended to clubs to supply information for a directory. It is believed that there are more clubs operating than are listed, which may not have been aware of the invitation.

In addition, information relating to some national societies is included.

INTERNATIONAL SOCIETIES

International Amateur Radio Union — c/- 225 Main Street, Newington, Connecticut, USA.

Radio Society of Great Britain — 35 Doughty Street, London, England.

New Zealand Association of Radio Transmitters — Box 1459, Christchurch, New Zealand.

American Radio Relay League — 225 Main Street, Newington, Connecticut, USA.

Radio Sports Federation of USSR — Box 88, Moscow, USSR.

Japan Amateur Radio League — Box 377, Tokyo Central, Japan.

Federation of Amateur Radio Societies of India — 4 Kurla Industrial Estate, Ghatkopar, Bombay, India.

Wireless Institute of Australia — Federal Executive, PO Box 150, Toorak, Melbourne, Victoria 3142.

Australian Capital Territory Division, — PO Box 1173, Canberra City, ACT 2601.

New South Wales Division — Wireless Institute Centre, 14 Atcheson Street, Crows Nest, NSW 2065.

Victorian Division, 412 Brunswick Street, Fitzroy, 3065.

Queensland Division — G.P.O. Box 638, Brisbane 4001.

South Australia Division — GPO Box 1234K Adelaide 5001.

Western Australia Division — GPO Box N 1002, Perth 6001.

Tasmanian Division — GPO Box 869J, Hobart 7001.

AUSTRALIAN RADIO CLUBS

Name: Sydney Chapter — Quarter Century Wireless Association.
Membership: Holders of an amateur licence for 25 years or more.
Meeting place: North Sydney Anzac Memorial Club, Bellvue Street, Cammeray.
Day and time: 2nd Wednesday of each month at 7.00pm.
Affiliation: Quarter Century Wireless Association, USA.
Net frequency: 146.25MHz and 28.25MHz Sunday evening 10.00pm.
Contact: President, Harry Caldecott, VK2DA; Secretary, Pierce Healy, VK2APQ; Treasurer, Brian Anderson, VK2AND at their call book address.

Name: ACT Division WIA.
Club Call sign: VK1ACA
Meeting place: The Studio, Griffin Centre, Canberra.
Day and time: 4th Monday each month at 8.00pm.
Affiliation: Wireless Institute of Australia.
Net frequency: 146.5MHz.
Contact: Andrew Davis, VK1DA, telephone 88 4899.

Name: Hunter Branch NSW Division WIA.
Club call sign: VK2AWX; repeater VK2RAN.
Meeting place: Newcastle Technical College, and Northumberland Radio Centre Teralba.
Day and time: 1st Friday of each month at NTC and 3rd Friday each month at NRC; 8.00pm.
Affiliation: NSW Division WIA.
Net frequency: 3595KHz each Monday evening at 7.30pm. Old channel 4 repeater.
Contact: Secretary Ray Leben, PO Box 134, Charlestown 2290. Bill Hall, VK2XT, phone 59-1586.

Name: Blue Mountains Branch, NSW Div. WIA.
Club call sign: VK2AUX.
Meeting place: Springwood Public School.
Day and time: 2nd Friday each month at 8.00pm.
Affiliation: NSW Division WIA.
Net frequency: 52.2MHz Sunday nights.
Contact: Hans Smit, VK2BHS, telephone Springwood 51 3534.

Name: Illawarra Branch NSW Div. WIA.
Club call sign: VK2AMW.
Meeting place: Wollongong Town Hall committee room.
Day and time: Second Monday each month at 7.30pm.
Affiliation: NSW Division WIA.
Net frequency: VHF repeater old channel 1; 432MHz moonbounce.
Contact: Secretary Ian Bowmaker, VK2ZJA, PO Box 110 Dapto, NSW 2530.

Name: Wagga District Radio Club.
Club call sign: VK2WG.
Meeting place: Civil Defence Headquarters, The Esplanade Wagga Wagga.
Day and time: Last Monday of each month at 8.00pm.
Affiliation: NSW Div. WIA.
Net frequency: 7100KHz and 146.00MHz.
Contact: Sid Ward, VK2SW telephone 22 6082 or Harry Hendriks, VK2ZHX, telephone 25 2005.

Name: Central Coast Amateur Radio Club.
Club call sign: VK2AFY; repeater VK2RAG.
Meeting place: Clubrooms, Dandaloo Street, Kariong.
Day and time: 1st and 2nd Friday evenings at 7.30pm.
Affiliation: NSW Division WIA.
Net frequency: Old channel 1 repeater.
Contact: Secretary Barry Gibbons, VK2ZUX, PO Box 238, Gosford 2250, telephone 25 1746.

Name: University of NSW Amateur Radio Society.
Club call sign: VK2BUV.
Meeting place: Room 1 stage 3 building, university campus.
Day and time: Each Wednesday 1.00 to 2.00.
Affiliation: NSW Div. WIA, Youth Radio Club Scheme, American Radio Relay League.
Net frequency: 27.125MHz (11 metre amateur band)
Contact: Sam Voron, VK2BVS, telephone 407 1066. Club postal address, The Union Box 57, PO Box 1, Kensington NSW 2033.

Name: Armidale Police Boys Radio Club.
Club call sign: VK2BAA.
Meeting place: Club rooms Rusden Street, Armidale.
Day and time: Wednesday nights at 7.30pm.
Affiliation: Part of Police Citizens Boys' Club.
Net frequency: 146.00MHz FM.
Contact: Bill Laird, VK2BLA or Ted Thrift, VK2ARA telephone 72 4631.

Name: Sydney University Amateur Radio Club.
Club call sign: VK2BSU.
Meeting place: Carslaw Tutorial Room 8.
Day and time: Each Wednesday at 1.00pm during term.
Contact: Jeff Pages, VK2BYY, telephone (02) 649 9829.
Postal address: Box 398 Wentworth Building, Sydney University, 2006.

Name: St George Amateur Radio Society.
Club call sign: VK2LE.
Meeting place: Rockdale Civil Defence Headquarters, Highgate Street, Bexley.
Day and time: First Wednesday of each month at 7.30pm.
Affiliation: NSW Div. WIA.
Net frequency: 14.1MHz.
Contact: Chris Jones, VK2ZDD, telephone 533 1755 or secretary SGARS, PO Box 77, Penshurst, 2222.

Name: Westlakes Radio Club.
Club call sign: VK2ATZ.
Meeting place: Club rooms, York Street, Teralba.
Day and time: Wednesday evening at 7.30pm and Saturday afternoons.
Affiliation: NSW Div. WIA and Youth Radio Club Scheme.
Net frequency: Not stated.
Contact: Joe Waugh, VK2IQ telephone (049) 68 2642 or Eric Brockbank, VK2ZOP PO Box 1 Teralba 2284, club telephone (049) 58 1588.

Name: Maitland Radio Club.
Club call sign: VK2BHV and VK2ZVM.
Meeting place: Clubrooms, 1 Maize Street, East Maitland.
Day and time: Third Wednesday each month at 7.30pm.
Affiliation: NSW Div. WIA and Youth Radio Club Scheme.
Net frequency: 146.00MHz FM.
Contact: Secretary, A. J. Watson, PO Box 59, East Maitland, 2323, telephone 37 2282. Club telephone 33 5680.

Name: Eastern Zone VK3.
Club call sign: VK3BEZ.
Meeting place: Morwell 1st Scout Hall.
Day and time: Bi-monthly as announced in "Eastern Zone news" and VK3WI broadcasts.
Affiliation: Victorian Division WIA.
Net frequency: 3650KHz Sunday evenings at 8.30pm also Latrobe Valley VHF repeater VK3RAB channel 44/54.
Contact: Bruce Hockings, VK3ADB telephone 34 2718, or secretary David Scott, VK3DY, 174 Johnston Street, Maffra 3860.

Name: Midland Zone WIA.
Club call sign: VK3ATO.
Meeting place: Scout Camp, Koolamut Park, Bendigo.
Day and time: 3rd Friday each alternate month at 8.00pm.

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent direct to Pierce Healy at 69 Taylor Street, Bankstown 2200.

AMATEUR BANDS

Affiliation: Victorian Division WIA.
Net frequency: Nil.
Contact: Col Gibson, VK3FO, telephone (054) 75 2245 or 75 2378.

Name: Moorabbin and District Radio Club.
Club call sign: VK3APC.
Meeting place: Moorabbin Baseball Club Rooms, Summit Avenue, Moorabbin.
Day and time: Third Friday of the month at 8.00pm.
Affiliation: Victorian Div. WIA.
Net frequency: Nil.
Contact: Secretary, PO Box 88 East Bentleigh 3165 or telephone 92 2168.

Name: Eastern and Mountain District Radio Club.
Club call sign: VK3ER.
Meeting place: Mooroolbark Technical School, Reay Road, Mooroolbark.
Day and time: Last Friday of each month at 8.00pm.
Affiliation: Not stated.
Net frequency: 3650KHz Monday evenings at 8.00pm.
Contact: Alex Bell, PO Box 87, Mitcham, 3132, telephone 874 1709.

Name: Geelong Amateur Radio — TV Club.
Club call sign: VK3ATL, repeater VK3RAG.
Meeting place: Clubrooms Storrer Street, East Geelong.
Day and time: Each Friday night at 7.30pm.
Affiliation: Victorian Division WIA.
Net frequency: Repeater channel 48/60.
Contact: Secretary David Mann, PO Box 520 Geelong 3220. Telephone 9 4261.

Name: Central Gippsland Youth Radio Club.
Club call sign: VK3AYE.
Meeting place: Traralgon and Trafalgar High Schools.
Day and time: Every Tuesday evening at 7.30pm.
Affiliation: WIA Youth Radio Club Scheme.
Net frequency: Not stated.
Contact: Brian Young, VK3BBB, PO Box 613, Traralgon, 3844.

Name: Darling Downs Radio Club.
Club call sign: Not yet allocated.
Meeting place: Dr. Price Memorial Centre, Little Street, Toowoomba.
Day and time: Last Friday of each month at 7.30pm.
Affiliation: Queensland Div. WIA.
Net frequency: 3650KHz and 146.00MHz at 8.00pm and 8.30pm respectively on 2nd Thursday of each month.
Contact: Ian Barnett, VK4ZBK telephone (076) 35 1309 or Tom Norris, VK4NO, telephone (076) 32 6972.

Name: The South East Radio Group.
Club call sign: Not allocated.
Meeting place: Rear 68 Sturt Street, Mount Gambier.
Day and time: Friday evening at 8.00pm.
Affiliation: WIA.
Net frequency: Not stated.
Contact: Peter Birrell. VK5ZTT, PO Box 1103 Mt Gambier, South Australia 5290.

Name: Black Forest Scout Group Youth Radio Club.
Club call sign: VK5KR.
Meeting place: Black Forest Scout Hall, Nottingham Crescent Glandore, Adelaide.
Day and time: Monday evenings at 7.00pm.
Affiliation: WIA Youth Radio Club Scheme; South Australia Scout Association Radio Branch.
Net frequency: 14.290MHz.
Contact: Stephan Daff, telephone 297 2685 or Geof Taylor, VK5TY telephone 293 5615.

Name: Australian Radio DX Club.
Affiliation: European DX Council.
Branches: New South Wales, Victoria and Queensland.
Meetings: Monthly.
Activity: To provide information for serious monitoring of commercial broadcasters also introduction to amateur radio activities.
Contact: Gregory J. Day, publicity officer, PO Box 227, Box Hill Victoria 3128.

ROSS HULL CONTEST

The WIA invites amateurs and short-wave listeners to join this contest, held to perpetuate the memory of Ross Hull, who did so much to further VHF-UHF.

A perpetual trophy is awarded annually for competition between WIA members.

The name of the winning member for each year is inscribed on the trophy and he also receives a suitably inscribed certificate.

Objects: Amateurs from Australia and territories will endeavour to contact as many other amateurs as possible under the following conditions:

Date of Contest: 6th December, 1974 1401GMT, to 19th Jan. 1975, 1400GMT. (0001 hours EAST 7th December 1974 to 2400 hours EAST. 19th Jan 1975.

Duration: Any seven calendar days within the dates mentioned, which need not be consecutive. A calendar day is from 1401 GMT to 1400 GMT.

RULES

1. There are two divisions: 48 hours, and seven days. In the seven day division there are four sections:
   (a) Transmitting, open.
   (b) Transmitting, 'phone.
   (c) Transmitting, CW.
   (d) Receiving, open.

In the 48 hours division the best score over any consecutive 48 hour period is the winner.

In the seven day division the best score over any seven days of the contest is the winner.

2. Any amateur operating fixed, mobile, or portable within the terms of his licence may participate.

3. All amateur VHF-UHF bands may be used but cross band contacts are not acceptable. At any one time, single frequency operating only is permitted. Cross mode contacts are permitted.

4. Amateurs may enter for any one of the sections and either or both divisions. The seven day division winner is not eligible for the 48 hour award.

5. Two contacts per band per day, irrespective of mode, are permitted provided that two hours elapse from the previous contact with that station on that band.

6. Logs from a multi-operator station are not acceptable. One operator only may operate a station at any one time and must submit a log for his own operation.

7. Entrants must operate within the terms of their licence.

8. The exchange of RS or RST reports with serial numbers beginning with 001 shall be proof of contact.

9. Entries should be set out on quarto sheets, using one side of the paper only, and must be forwarded to reach the WIA Federal Contest Manager, Box 67, East Melbourne, 3002, by Friday 21st February 1975. Envelopes should be clearly marked "Ross Hull Contest". Early logs are appreciated.

10. Scoring will be based on the attached table of distances. Approximate distances are to be shown in the log. Operation via repeaters or translators is not permitted.

SCORING TABLE

km	52 MHz	144 MHz	420 MHz	576 MHz	Higher
50	1	1	2	5	10
50–100	2	2	5	10	25
100–150	5	5	15	30	50
150–300	10	10	25	50	100
300–500	25	15	50	150	250
500–800	20	25	100	250	300
800–1200	15	35	200	300	350
1200–2000	10	75	250	350	400
2000–4000	25	125	300	450	500
4000–6000	35	200	400	500	600
6000–9000	50	300	450	550	650
9000	100	400	500	600	700

11. Logs must carry a front sheet with the following information:

Name .....
Address .....
Section .....
Callsign .....
Claimed 7 day score .....
Operating dates .....
Highest 48 hour score .....
Operating period .....
I hereby certify that I have operated in accordance with the rules and spirit of the contest .....
.....
Comments .....

12. All times are to be logged in GMT.

13. Certificates will be awarded to the winners of each section of each call area. Certificates will be awarded to contestants who break any Australian VHF-UHF distance records.

RECEIVING SECTION

1. Short-wave listeners may enter for this section.

2. Contest times and logging will be the same as for the transmitting section except that there will not be a 48 hour division.

3. Logs must show the call-sign of the calling station, the serial number given, and the call-sign of the other station. Scoring will be as for transmitting stations.

4. Any scoring contacts may be logged. There is no limit to the number of times that a station may be logged provided serial numbers are given.

5. The logs for any seven days (calendar) may be submitted and the winner of the section will be the highest scorer.

6. Certificates will be awarded to the highest scorer and, if sufficient interest is shown, to state winners.

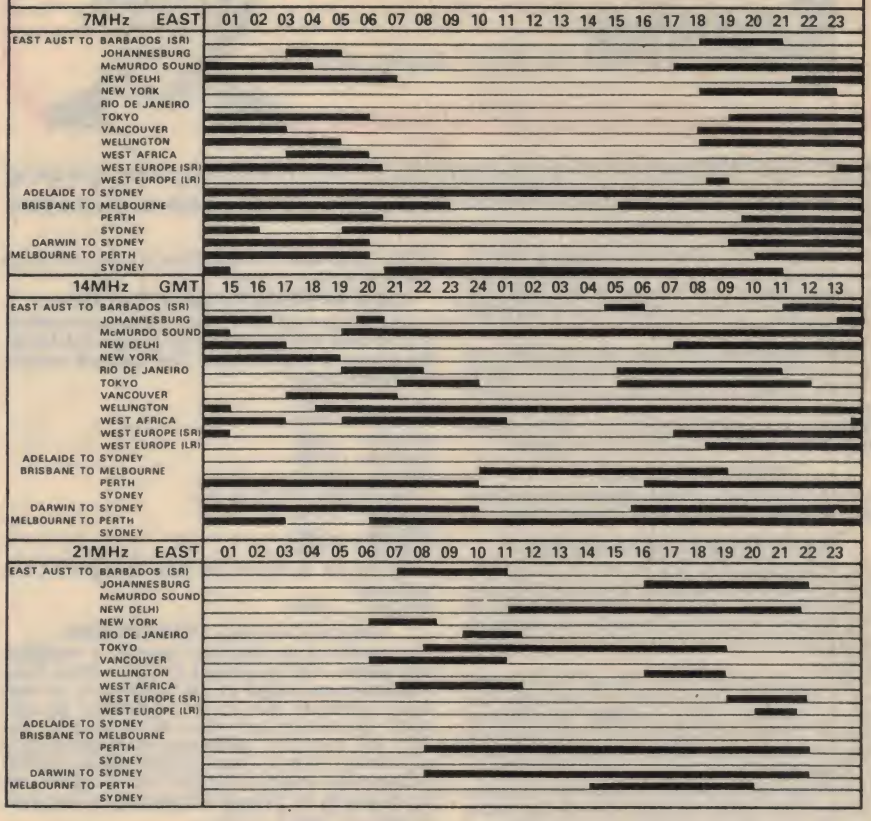
7. A certificate will be awarded to the club station with the highest 7 day score.

General

It is preferable that complete logs be submitted as an aid to checking but contestants must clearly show their best seven days or 48 hours. Enjoy yourself in another friendly contest. Try to exchange names with each contact.

IONOSPHERIC PREDICTIONS FOR DECEMBER

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Department of Science. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open. 12.74



RADIO CLUB NEWS

UNSWARS Study Classes

To assist persons to gain an amateur licence at the PMG's examination in February, 1975, a series of study classes will be conducted by the University of NSW Amateur Radio Society. Classes commence Friday evening 13th December, 1974 at 7.00pm, in Room G25, ground floor, Electrical Engineering building University NSW, Kensington.

Morse code classes will be held from 6.00pm to 7.00pm, prior to the theory classes. Following completion of the theory classes on 24th January, 1975, additional Morse classes will be held from 6.00pm to 8.00pm each Monday, Tuesday, and Wednesday evenings until the examination date. Additional assistance will also be available during that period in theory and PMG regulations.

If parents bring prospective students to the first class, arrangements will be made for reliable transport, where possible, for later classes. The only fee for the course will be $5.00 to cover printed material.

For full details contact — Sam Voron, VK2BVS, 2 Griffith Avenue, East Roseville, 2069. Telephone 407 1066. The Society's postal address is — The Union Box 57, PO Box 1, Kensington 2033.

In addition to the study groups it is hoped to organise other activities to give the newcomer a better insight to amateur radio. These may include "do it yourself" projects, and non-technical talks on topics associated with amateur radio.

Any amateur who would be willing to assist is invited to contact Sam Voron, VK2BVS.

Wagga Convention

A very successful convention of the NSW Division WIA, South West Zone was held at Wagga Wagga over the holiday weekend in October. Activities commenced on the Saturday afternoon. At the convention dinner on Saturday night more than 80 persons were present. Harry Hendriks, VK2ZHX, president of the Wagga District Radio Club presided. Speakers were South West Zone officer, Harry Cuthbert, VK2AEC, who welcomed all present; Tony Mulcahy, VK2ACV president NSW Division WIA, who spoke on Institute matters and Pierce Healy, VK2APQ who officially opened the convention. In doing so, Pierce congratulated the members for the very fine job done during the recent major floods in the area.

All field events were enthusiastically contested. The highlights of the Sunday activities were tele-recorded and shown on CCTV on Sunday evening. A wide range of prizes were presented and the organisers expressed their appreciation to the large number of business houses who made donations.

Plans are already under way for the 1975 convention.

Incidentally, the Wagga District Radio Club was again called upon to provide communication for the civil defence authority during major flooding around the 19th — 21st October, 1974.

Visitors to the convention who saw the area affected by the August-September floods could appreciate the task carried out by the WDRC. A striking example of assistance provided to the community by amateur radio.

Shortwave Scene

by Arthur Cushen, MBE

Two Gospel stations are in the news with KGEI, San Francisco, now operating with 250kW, while test transmissions from Trans World Radio in Swaziland have also been reported.

After many months of speculation that KGEI had increased its power, the station has supplied us with its new schedule due to come into effect this month. This shows the use of two transmitters — one of 50kW and one of 250kW.

English broadcasts are from 0700-0900 GMT and from 1400-1500GMT. The balance of programming on the 250kW transmitter from 0900 GMT is in Asian languages.

Programs on the 50kW transmitter are all beamed to Latin America in either Spanish or Portuguese.

TWR SWAZILAND

The new transmitters of Trans World Radio are now operating from Swaziland with Gospel programs.

McMURDO RADIO VERIFIES

Our verification from the American Forces Antarctic Network has been received, and this came in a form of a letter and verification card. We understand this is the first verification issued by the station as others received have been in the form of a teleprinter message.

Details of the reception of this new station were given in the October issue when its broadcasts were heard on 6012kHz around 0700GMT. According to William R. Carter, AFAN Station Manager, the station broadcasts from studios "in downtown McMurdo", and are relayed to the transmitter which is situated on a hill some three miles south of the base and overlooking Scott Base. The programs are live, with disc jockey type format from 1800-1300GMT, and the balance of programs transcribed. Our report was sent to "Deep Freeze Headquarters," at Christchurch International Airport for forwarding to the station. This verification was the 227th country we have verified on shortwave.

RADIO SURCOLOMBIANA

Over the past few months, a Colombian station has been heard on 5010kHz after Radio Echo closes down. This station has now been identified as Radio Surcolombiana and has been operating 24 hours a day. According to a verification letter received from the station by Stephen Greenyer of Invercargill NZ, the station is located in Neiva, Colombia. Broadcasts have been observed with another slogan "The Voice of the Future."

According to the letter, two stations are operated — HJOV on 1180kHz with 15kW, and HJOX on 5010kHz with 2.5kW. Radio Surcolombiana is the property of "Jorge Eliecer Gaitain", and is non-commercial.

RADIO NORTH SEA MOVES

Radio North Sea International, which has been broadcasting off the coast of Holland for some years and has been heard regularly on 6210kHz, has closed down due to the Dutch Government introducing the Dutch Marine Offence Act, which bans off-shore radio stations. After re-fitting, Radio North Sea is sailing to a point off the coast of Italy, and will broadcast from the Genoa area. The ship will be then known as Radio Nova International, and will operate on 1367kHz MW and 6210kHz SW. According to Sweden Calling DXers, the station plans a world-service in English on Sundays to be broadcast on shortwave.

Further information in ADXN from Michael Willis states that he heard the closing announcement of the station in which they stated they would be moving to the Mediterranean. Of the other two stations which broadcast off the coast of Holland, Radio Veronica has not been able to gain a land based licence and has closed, while Radio Caroline plans to continue with its offices located in Britain.

NEW AUSTRIAN FREQUENCIES—

The Austrian Radio at Vienna in its present schedule is using some new frequencies for Europe and Africa. The service to Australia and New Zealand remains unchanged and is:

GMT	kHz
0400-0600	17800
0600-0900	17850
1200-1500	17775
1500-1700	15155

The changes to Europe are:

1900-2200	9710
1200-1300	11965
2100-2200	7105

The service to Africa has been changed for one frequency:

1900-2100	11945

INSTALLATION COMMENCES

As mentioned on this page recently, a combined relay station to be operated by the BBC and the Voice of Germany on Antigua in the Caribbean is to commence operations shortly. The tenders for the four 250kW transmitters have been let to Marconi, and these are currently undergoing construction. The transmitters will be the same as those used by the BBC at other relay stations and in the United Kingdom, and also as used by the Voice of Germany at its relay base at Kigali in Central Africa.

The introduction of this relay station will improve the services from London and Cologne in the Americas and in the Pacific area.

ENGLISH FROM PYONGYANG

A new transmission in English at 2000GMT has been noted on 9415kHz from Radio Pyongyang. The North Korean station has been using this frequency on an irregular basis, and has been causing interference to the BBC on 9410kHz.

Other English broadcasts have been published, which give the schedule as: 0600GMT on 12075 and 9820kHz; 1200GMT on 15630, 12075 and 9370kHz; 2300GMT on 15630, 12075 and 9410kHz.

STRONGER RAROTONGAN SIGNALS

Listeners in both Australia and New Zealand are reporting better reception of Radio Rarotonga in the Cook Islands since its increase in power to 5kW. Reception has been best on 5045kHz up to close down at 0900GMT According to the closing announcement, the station opens at 1630GMT, and at this time has been heard on the medium-wave frequency of 600kHz.

ENGLISH FROM INDONESIA

According to the New Zealand DX Times, several regional stations in Indonesia have been observed with broadcasts in English. The Radio Republik Indonesia station Sorong on Irian Barat, formerly West Irian, has been heard with a Mailbag session at 1140GMT. Nigel Robins reports that the station has a request program of music for listeners who write in.

English has also been heard from RRI Jogyakarta on 7110kHz at 1130GMT. The station had news and popular music up to 1145GMT when it broadcast a transcribed program "Keep up your English".

MEDIUM WAVE NEWS

IRAN: A new transmitter of 2000kW is now operating on 558kHz according to Medium Wave News. The transmitter is located at Quaz viu Plain, and carries Radio Iran programs from 0230-2040GMT.

DUBAI: The Arabic speaking station on 1480kHz, which has been heard in New Zealand around dawn under Radio Hauraki, has been identified as Radio Dubai. According to Sunspot Magazine, the power of this transmitter is 600kW. Its identification in this area has been difficult due to the severe interference of Radio Hauraki, which operates 24 hours a day.

DIEGO GARCIA: An area very much in the news is the small island of Diego Garcia in the Indian Ocean. The island is currently under consideration by the Americans as a future naval base. According to the UADX Bulletin, the island's radio station has been heard by Victor Goonetilleke of Sri Lanka on 1475kHz with AFRTVS programs. It is understood the power is 50W. The station has also been heard by Craig Tyson of Wembley, WA.

CANTON ISLAND: According to Merv Branks of Invercargill, NZ, the following details have been received from Max A. Chapman, the new Station Director of WXLE Radio. The station, regularly heard in New Zealand on 1385kHz, is located on Canton Island in the Phoenix Island Group. Power is 250 watts non-directional and schedule 24 hours a day, 7 days a week. Canton Island is used as a USAF Tracking Station, and WXLE is provided mainly as entertainment for Island residents, though numerous reports are received from California, Hawaii and New Zealand. The address is: Global Associates, Box 1276, APO San Francisco 96401.

LISTENING BRIEFS

EUROPE

POLAND: According to Dene Lynneberg of Wellington, reporting in the NZ DX Times, the Polish Pathfinder radio has confirmed his reception, and gives their present schedule as weekdays, except Mondays, on 6850kHz 300W 1100-1700GMT, and Sunday at 0900-1700GMT. A second frequency of 7306kHz 300W is also used.

BULGARIA: Radio Sofia will get two new SW Transmitters of 500kW each for its foreign service. They are Soviet-made and will be operating this month.

CZECHOSLOVAKIA: Radio Prague is using the new frequency of 6015kHz from 1930-2257GMT, while the frequency of 9630kHz has replaced 9740kHz for the period 2130-0500GMT.

AFRICA

SOMALIA: Radio Hargeisha has been heard by John Pickering of Adelaide on 7120kHz from opening at 1430GMT. There was some sideband interference from All India Radio on 7125kHz, which also opens at 1430GMT. After 1630GMT there is little interference, but at 1700GMT the BBC opens on 7120kHz, making further reception impossible.

ALGERIA: According to Sweden Calling DXers, English is now broadcast by Radio Algiers from 1900-1930GMT. Three frequencies are used: 15160, 17745 and 17825kHz. The program consists of news, topical talks and music.

CAMEROON: A press report indicates that a French firm is constructing high-powered equipment for the Cameroons. This will consist of three MW transmitters of 20kW each, three SW transmitters of 100kW each and one SW transmitter of 20kW. At the same time the broadcasting studios at Yaounde will be enlarged. The 100kW transmitters are planned for external service.

ASIA

PAKISTAN: According to the Australian Radio DX News, the slow speed news bulletins of Radio Pakistan are now broadcast 0230-0245GMT 21730, 17830kHz; 0430-0445GMT 21590, 17830, 15325kHz; 1100-1115GMT 17910, 15115kHz; 1530-1545GMT 15520, 11672kHz; 1745-1800GMT 11672, 9690kHz.

INDIA: The General Overseas Service of All India Radio in English from 1000-1100GMT is on 11725, 15190, and 17780kHz to North East Asia, and to Australia and New Zealand on 11775, 15190 and 17780kHz.

SARAWAK: According to the New Zealand DX Times, John Mainland has heard Radio Sarawak on the new frequency of 6050kHz. Broadcasts were observed at 0958GMT when the interval signal was played and the transmission commenced at 1000GMT.

SINGAPORE: The following schedule, received from Radio Singapore, indicates that the following services are now broadcast as follows: English from 2230-1630 GMT on 7250 and 11940 kHz; Malay from 2230-1630GMT on 7250 and 6155kHz; Chinese from 2230-1630GMT on 6000 and 9635kHz; Indian languages from 2230-1330GMT on 7170kHz.

AMERICAS

VENEZUELA: Radio Reloj Continente, Caracas, has been heard by J. Lewry of Newport Victoria on 5030kHz. The station was heard with an interval signal at 0957GMT and commenced transmission at 1000GMT.

MEXICO: XERH has returned to 11880kHz after some months of absence, and programs of Latin American music have been heard in Europe from 0030-0300GMT. the frequency of 15110kHz, which also carries the same program, has been heard around 1800GMT, and the station announces the power as 25kW. Radio Mexico, XERMH is now using 9705, 11770, 15125 and 21705kHz, and has been heard on these frequencies at 2300GMT. Another Mexican station, Radio Universidad on 9600kHz, is also reported to be operating 1300-0500GMT.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT, add 9 hours for West Aust. Summer time, 11 hours for East Aust. Summer time and 13 hours for NZ Summer time.

READERS PRIVELEGE OFFER

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Please send me ..... TRAFALGAR TRAVEL & HOME FIRST AID KITS at the special readers only price of $18.50 each, saving me $10 on the normal price.

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50 WATT GUITAR AMPLIFIER

Introducing our fabulous 50 Watt guitar amplifier kitset — using a new technique for your protection. Both preamps and main amps are duplicated, and internally wired together, so that in the unlikely event of one channel developing a fault the other will continue to operate. Look at these features ...

- Feeds two speaker cabinets with 25 watts each. This gives a total genuine power output of 50 WATTS RMS.
- Unique tone control circuitry provides wide range of tones for Lead Guitar, Rythme Guitar, Bass Guitar, Organ, and P.A.
- The preamps and power amps have been preassembled and tested so the total assembly time of your kit should not exceed 6 - 8 hours.
- Very little electronic knowledge is required to assemble this kit, mainly the ability to use a soldering iron.
- The output stages are Intergrated circuit devices and are protected by fuses in case of a loudspeaker short. The entire amplifier consists of transistors and integrated circuits.
- The unit is supplied with prepunched chassis (most parts already mounted for you), an attractive vinyl covered wooden cabinet, and highly attractive front panel. The unit, when completed, looks fully commercial.
- The unit is half the weight of current outdated commercial units, and about half the price.

Why pay over $300 for a unit — our price is only **$199** Add $5 freight to Australia & Islands

5 watt amp kit

A simple amplifier, in kitset form, that can be assembled in under 2 hours.
STEP BY STEP PICTORIAL INSTRUCTIONS
Only 4 transistors, 10 resistors, and 5 condensers to solder in place.

OPERATES OFF 9-18 VOLTS
Power supply circuitry provided. Runs off battery or power supply.
Input Z 20k
Input sens. 20mv
Output load 3-15 ohms

$7.00

VIBRA-SOUND KIT

(The Electronic equivalent of the mechanical rotating speaker system)

This kit simulates the sounds produced by the various rotating speaker systems. By electronically rotating the phase of the signals, a Doppler effect is produced. A special feedback circuit enhances the resultant sound. Speed and depth are adjustable. The unit comes with PC board, components, switches, and instructions. The power supply is not provided, but details of a simple supply are given. It runs off 16-18v DC and draws about 50ma. PRICE

$19.00

6 + 6 watt

A low cost good quality stereo amp kit delivering 6 watts peak per channel. Ideal for the average living room. Supplied with print circuit boards, all components, anodised front panel, speaker screw terminal strip, screened cable, hookup wire etc. Kit does **not** include chassis, cabinet, knobs or power xfmr. This keeps the kit cost way down, and means you can press into service any 12-14 volt xfmr you happen to have. A standard bell transformer is ideal. However, complete operating notes are included with the circuit details, also recommended chassis layout. Connection details are also given for headphones. Input impedance is 2 meg ohms, and the amp can be driven from a xtal or ceramic pickup, or from a tuner or tape recorder. The baxandell tone controls give a wide range of bass and treble.
LIMITED SUPPLY AT ONLY **$28.00**

STEREO MIXER KIT

A four channel battery operated stereo mixer kit designed for microphones, guitars, etc., with the following features — 4 inputs with individual level controls, each input switchable from 600 ohms to 50k ohms, runs off a 9v battery, switchable stereo or mono output, headphone monitor provided, low flat response, up to 10db gain.

Supplied with PC board, components, pots, switches, sockets. ONLY

$19.50

NEW VHF KIT

A completely new version of our popular VHF kit — covers from 25-150 mhz. Pictorial assembly instructions make it an ideal kit for a learner. Works in conjunction with an ordinary broadcast receiver. Just stand it alongside your ordinary transistor radio (no connection required) and listen to the exciting world on VHF. Receives taxis, aircraft, Police, fire brigade, 2 meter Ham band, citizens' band. Fantastic night time entertainment. All yours for only **$6.00**

ITEMS REQUIRED.....

.....

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I enclose Bank draft/Commonwealth Money Order.
Do not send personal cheques or postal notes.

NAME:.....

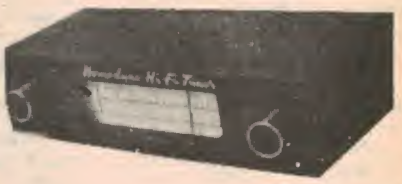
ADDRESS:.....

Send this coupon to

WELLINGTON **KIT PARTS LTD** ALL RADIO COMPONENTS
P.O. BOX 27 037, Wellington, New Zealand.

MONEY BACK IF NOT COMPLETELY SATISFIED

DEAR KIT PARTS — PLEASE RUSH MY ORDER — THIS BATH IS GETTING COLD!



HOMODYNE TUNER KITSET

(from Electronics Australia) Complete with attractive anodised cabinet and silk screened front. $25.00.

INFORMATION CENTRE

AUTOMATIC BATTERY CHARGER: I am about to build the Automatic Battery Charger described in October 1971 (2/BC/9). So far I have gathered all components except the C103Y SCR and the 0.22 ohm 5 watt resistor. It would appear the nearest substitutes I can obtain are a C103B SCR and 2 only 0.47ohm 10W resistors in parallel. I have been wondering if these would be satisfactory. I have also been able to obtain only 12V 100mA bezel globes instead of the 200mA globes specified in the circuit diagram.

I have also been wondering if you would still have available, or can advise where there may be available, the front panel printed or engraved label for this unit.

I would also be pleased if you could supply any information re modifications and cross-over network for a Magnavox speaker enclosure using one 8-30 speaker, one 6J mid-range speaker and one Philips dome tweeter. I have the details for a similar unit using two Magnavox 3TC tweeters. I have the details for the original unit (without 6J midrange) and then the modified unit which replaced the 3TC tweeters with one Philips Dome tweeter.

It would seem to me that the inclusion of the midrange 6J to this modification would provide the best results yet and I would be pleased to hear of any test or results if available together with the modification details. (J.B., Elsternwick, Vic).

The suggested substitutes you have listed for the Automatic Battery charger should all be satisfactory.

On the subject of the Magnavox 8.30, "Electronics Australia" has published only one article, in January 1971, (File 1/SE/25) so, strictly speaking, we cannot supply any information on the other versions. However we can comment that there is probably little to choose between versions using the Magnavox or Philips tweeters. We have yet to be convinced that the addition of the 6J midrange improves the sound of either version.

FUZZ BOX: I refer to the circuit under the heading "Schmitt Trigger or Bistable Buffer" in Circuit & Design Ideas for May of this year. I was wondering whether this circuit could form the basis for a guitar fuzz box. I understand that the fuzz sound is produced by a squaring of the guitar output. Although I have made up a number of fuzz box circuits in the past, the performance has not been very acceptable. If the Schmitt trigger circuit were used, would the output still carry the natural decay sound of the guitar or would it suddenly switch off as the guitar output drops? Perhaps an article could be prepared using the Schmitt trigger idea. (S.D., Cobden, Victoria.)

What we do not know about guitar fuzz boxes S.D., would fill a large book. The suggestion is an interesting one but we agree that the problem of the Schmitt trigger dropping out at low output levels from the guitar would be very real and this alone would possibly rule out the idea. There may be other readers who are in a position to help you with this problem and we suggest that they may put idea to paper. We will be pleased to take it from there. We have described a quite successful fuzz box and this appeared in August, 1967 (File No 1 GA 10). This amplified and clipped the output from the guitar and provided the amplification is great enough, clipping will continue down to quite low output from the guitar.

MUSICAL TONE GENERATOR: With reference to the project describing the musical tone generator, I would like to ask a few questions. Firstly, could you give some indication of how stable the tone should actually be and would atmospheric temperature changes affect the stability of frequency?

Secondly, in the article it is stated that a square wave at the speaker is no problem. However, I feel it could be quite difficult to tune an instrument to a sound which to me sounds slightly distorted and thin in comparison to a sine wave. I would appreciate further comment. Thanks for the article, I have been waiting for something like this for a long time. (T.D., Lyons, ACT.)

With regard to your first question, as stated in the text, the error due to the compromise in the division ratios is approximately 0.11pc. The error due to incorrect crystal frequency would be approximately 0.045pc. The maximum expected frequency deviation of a 2MHz crystal due to changes in ambient temperature would be of the order of 100Hz (at 2MHz) giving a percentage change of 0.005pc. This is negligible in comparison with the previously mentioned inherent errors, which themselves are so small that musically they are negligible.

When the unit was being developed we tested it in practical situations, to see if tuning presented any problems because of the square wave output. If our experience is any guide, you should experience no problems, although this is not to say that the job wouldn't be slightly easier with sine wave output. The design as presented is essentially a practical compromise, because it is not easy to filter a signal which varies in frequency from 20Hz to 8kHz.

SILICON BILATERAL SWITCH: I am at present constructing the AC voltage regulator which appeared in the February, 1972, issue (File 2/PC/17). It would seem that the silicon bilateral switch (MBS4991 or D13E1) used in the regulator is unavailable in WA. I would be grateful if you could tell me of any suppliers in the eastern states who can supply the above device or of a substitute that may be used.

Thank you for producing a really good magazine. (D.P., Swan View, WA.)

A quick check shows that D13E1 devices have always been in good supply so you should have no trouble obtaining one from any advertisers who specialise in parts for our projects.

CORE BALANCE EARTH LEAKAGE DETECTOR: Could you please tell me how these devices work? (enclosed is a cutting from a newspaper). Possibly an article on these could be published in the magazine. If not too difficult could a home constructor make one? (K. McC., Surfers Paradise, Qld.)

We have already published such an article; in August 1973 (File No. 8/DT/68). These devices are not suitable for home construction.

TRANSISTOR AMPLIFIER: I am a 13 year old pupil of Epping Boys' High School and I an interested in obtaining a printed circuit of a transistor amplifier. Could you please tell me where I could get one? (G. MacG., Eastwood, NSW.)

Although you do not say so specifically, we imagine that you refer to an audio amplifier. We have a simple basic design which may suit your purpose. It was described in Elementary Electronics for February, 1974 (File No. 8/DT/75). We do not deal in components but the printed board (71/A8) may be obtained at most components sellers.

SUPERFET: Could you please tell me how to greatly increase the selectivity of the Superfet radio. Have you ever published a simple amplifier to go with it? Thank you for publishing Elementary Electronics. (N.H., Mildura, Vic.)

It sounds to us as though your Superfet is not regenerating, N.H. If your set is not regenerating, both sensitivity and selectivity would suffer. Try reversing the connections to the feedback winding. There should be a very noticeable difference as the feedback winding is moved along the ferrite rod and back again. We have not described an amplifier to suit the Superfet.

PLAYMASTER 140: I wish to compliment you on the standard and variety of articles which you present. I have recently completed the Playmaster 140 and I am very satisfied with it. It was my first constructional project and I am sure that its success is largely due to the manner in which it was presented. I read with interest in the July issue that Signetics have produced an IC CD-4 decoder. Could you please publish a CD-4 decoder module compatible with the Playmaster 140 as soon as practicable — possibly using that IC? (B.W.T., Noble Park, Victoria.)

Thank you for your remarks relating to the quality of the magazine. We are also pleased to know that you have had such success with your Playmaster 140 project. Your suggestion re the use of the Signetics IC for a CD-4 decoder seems a good one and the possibility of presenting such a project will be looked at to see if it would be feasible.

PLAYMASTER 128: What is the purpose of the 2.2 ohm resistor in the earth path of this unit's power amplifier. (A.P., Wollstonecraft, NSW.)

The purpose of the resistor is to prevent severe harmonic distortion caused by heavy asymmetrical earth currents from the output stage inducing small voltages at the input of the amplifier via the signal earth. Placing the resistance in series with the signal and output earth paths reduces the problem. However, there is another way out of this problem. It is only necessary to prevent output earth currents flowing in the earth returns of the earlier stages and this can be done by simply removing the resistor and earthing the copper pattern of the pre-driver stages (previously earthed via the resistor) separately back to the common earth point.

HOW DOES IT WORK: Upon reading the new section "How Does It Work" it struck me that many people do not know how a proximity switch works. Can you help? (A.B., Lesmurdie, WA.)

A proximity switch was described in the magazine in June 1971 (File No 2/MS/21) and a description of its operation was contained in this article. However, we will keep the idea in mind should space be available. Thank you for writing.

CASSETTE: I am going to build your 21 watt utility amplifier described in October 72, and would like to know a couple of things. Firstly, I wish to use my cassette recorder with it — and the recorder has only an ext. speaker socket. Can I plug this into the amplifier. Also, you said the Magnavox 8-30 was a good speaker for this amplifier. Is there a cheaper speaker? Where do I get a design for a box? Lastly, can you tell me how to calculate the value of speaker impedance when two or more speakers are in series or parallel. (R.W., Scarness, Qld.)

You can use your cassette recorder with the amplifier. Connect a resistor (1/2W or more) across the output of the cassette recorder amplifier. The value of this resistor is not critical — anything between say, 12 and 30 ohms should be quite satisfactory. Connect leads from this resistor to the high input of the amplifier.

The speaker recommended appeared to be one of the best around at the time in that price range. Doubtless there are others for the job — ask your parts supplier.

To work out approximate speaker impedances, treat

If you are unable to complete an "Electronics Australia" project because you missed out on your regular issue, we can usually provide emergency assistance on the following basis:

PHOTOSTAT COPIES: $2 per project, or $2 per part where a project spreads over multiple issues. Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries.

METALWORK DYELINES: Available for most projects at $2 each, showing dimensions, holes, cutouts, etc., but no wiring details.

PRINTED BOARD PATTERNS: Actual size dyeline transparencies: $2 each. Specify positive or negative. We do not sell PC boards.

REPLIES BY POST: Limited to advice concerning projects published within the past 2 years. Charge $2. We cannot provide lengthy answers, undertake special research or discuss design changes.

BACK NUMBERS: Only as available. Within last 6 months, face value. 7-12 months, add 5c surcharge; 13 months or older, add 10c surcharge. Post and packing 60c per issue extra.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee, for reply in the magazine, at the discretion of the Editor.

COMMERCIAL, SURPLUS EQUIPMENT: No information can be supplied.

COMPONENTS: We do not deal in electronic components. Prices, specifications, etc should be sought from advertisers or agents.

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield, 2014.

NEW RH (Radio House) RANGE OF MULTIMETERS

MODEL RH-20 $20.00

Packing & Postage $1.00.

20,000 Ohms per Volt DC.
10,000 Ohms per Volt AC.

Specifications:
DC Volts: 0.25, 2.5, 10, 50, 250, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current, 50uA, 25mA, 250mA.
Resistance: 7K, 700K, 7M.
Decibels: —10, +22 (at AC/10V) +20, +36 (at AC/50V). Upper frequency limit 7KHZ.
Batteries: Two 1.5V dry cells.
Complete with test leads

MODEL RH-80 $22.00

Packing & Postage $1.00.

20,000 Ohms per volt DC.
10,000 Ohms per volt AC.

Specifications:
DC Volts: 0.5, 2.5, 10, 50, 250, 500, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: 50uA, 5mA, 50mA, 500mA.
Resistance: 5K, 50K, 500K, 5M.
Decibels: —10dB + 62dB.
Accuracy: DC 3pc.
AC 4 per cent (of full scale).
Batteries: Two 1.5V dry cells, size AA, "Eveready" 915.

MODEL RH-60 $29.00

Packing & Postage $1.00

50,000 ohms per Volt DC.
10,000 Ohms per Volt AC.

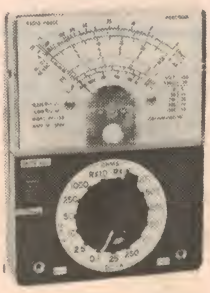
Specifications:
DC Volts; 0.25, 2.5, 10, 50, 250, 500, 1000
AC Volts: 10, 50, 250, 500, 1000.
DC Current: 25uA, 5mA, 50mA, 500mA
Resistance: 10K, 100K, 1M, 10M.
Decibels: —10 +62dB.
Accuracy: DC ±3 pc., AC ±4 p.c. (of full scale).
Batteries: Two 1.5V dry cells. Overload protected.

"HANDYMAN" RH-150 $14.75

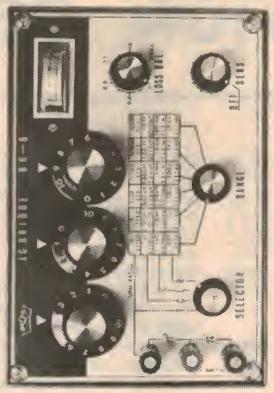
CHECKED PACKED & POSTED $15.50

Pocket size 3¼" x 4½" x 1¼". Instruction sheet and circuit.

SPECIFICATIONS:
DC Volts: 2.5, 10, 50, 250, 1000. 10,000 ohms per volt
AC Volts: 10, 50, 250, 500, 1000. DC Current: .1, 25, 250mA. Resistance: 20K and 2M. Decibels: —20dB, +62dB, 0.7KHz.
Capacitance: .0001, 01, .0025, 25uF.



AC BRIDGE. MODEL BR-8.



SPECIFICATIONS

Ranges:
R: 0.1 Ohms～11.1M Ohms. Accuracy: 0.1 Ohms～10Ohms: ±2% ±0.1 Ohms; 10 Ohms～5M Ohms: ±1%; 5M Ohms～11.1M ohms: ±5%.
L: 1uH～111H. Accuracy: 1uH～100uH: ±5% ±1uH: 1mH～111H: ±2%.
C: 10pF:～1110uF. Accuracy: 10PF～1000PF: ±2% + 10PF; 111PF～111uF: ±1% 1.5%; 111uF～1110uF; ±5%.
T: 1/10000～1: 11100; Accuracy; ±1%～1.5%.
Power Source: DC9V (oo6PX1).
Bridge Power Source: 1KC.
Net Weight: 1Kg.
Dimensions: 128mm x 182mm x 75mm.

$49.75. Packing & Postage $1.00

WORLD RANGE RADIO

10 Bands Solid State, Battery and 240 Mains Operation

Specifications: 14 Transistors, 6 Diodes, 1 Thermistor.

1. **Tuning Range and Intermediate Frequency**

Amplitude Modulation	(AM) 535-1600KHz	455KHz
Marine Band	(MB) 1.5-4 OMHz	455KHz
International Short Wave — 1	(SW1) 4-6MHz	455KHz
International Short Wave — 2	(SW2) 6-12MHz	455KHz
International Short Wave — 3	(SW3) 12-16MHz	455KHz
International Short Wave — 4	(SW4) 16-24MHz	455KHz
Frequency Modulation	(FM) 88-108MHz	10.7MHz
Aircraft	(VHF1) 108-140MHz	10.7MHz
Police Band	(VHF2) 140-173MHz	10.7MHz
Weather Band	(WB) 162.40-162.55MHz	

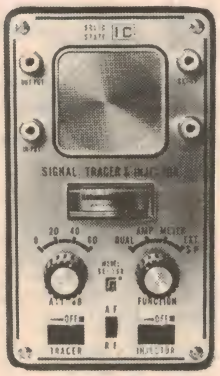
2. **Antenna**
Built-in Ferrite bar antenna for AM, MB.
Built-in Telescopic antenna for SW1, SW2, SW3, SW4, FM, VHF1, VHF2, WB (swivel-type telescopic directional antenna).

3. **Output Power**
Undistorted Power 600mW.

4. **Power Supply**
DC6V: UM-1 ("D") size flashlight battery x 4, or 240 Volts.
5. Speaker 3.5" Round PM dynamic
6. Earphone 8 ohm Magnetic earphone
7. Dimension 11" (H) x 13" (W) x 5" (D).
8. Weight Approximately 8 lbs (Without batteries)

$135.00 Packing & Postage $1.50.

SIGNAL TRACER/INJECTOR. MODEL SE-360.



SPECIFICATIONS

Gain: 60 dB.
Attenuation Factor: 0-20-40-60 dB.
Input Impedance: Over 75K ohms.
Output Impedance: Ext. Speaker 8 ohms.
Output: 600 ohms unbalanced.
Meter: VU 200uA.
Speaker: 2-¼" dynamic.
Power Supply: Dry Cell BL006P 9V x 1.
Size: 150 (5-13/16) x 85 (3-11/32) x 52mm (2-1/64").
Weight: Approx. 500gs (1.10 Lbs.).
(SE-360 Injector portion)
Frequency: Approx. 1KHz square wave form.
Output Level: Max. 5V (0-5V continuously variable).
Note: Each unit supplied with test leads (Test prod x 1 and test clip x 1).

$35.00. Packing & Postage $1.00

RADIO HOUSE PTY. LTD.

306-308 PITT STREET 61-3832 26-2817 760 GEORGE STREET SYDNEY. 211-0171

INFORMATION CENTRE

them as resistors — ie, two 8 ohm speakers in series would be 16 ohms; two 8 ohm speakers in parallel would be 4 ohms, etc.

SQ DECODERS: I have been buying "Electronics Australia" for the last nine years, and although I have only tackled a couple of projects I am always interested in reading the magazine. I find the range of technical and general interest articles is very well balanced.

My query concerns SQ decoders for quadraphonic records. Is it necessary to have the decoder before the amplifier (requiring a 4-channel amplifier), or is it possible to place a decoder between the output of an ordinary stereo amplifier and the speakers? If the latter is the case, could you please publish a design for the construction of such a unit which could preferably be incorporated into a commercially produced modular stereo system. (I. McA ., Nedlands, WA.)

Thank you for your comments about the magazine. An SQ decoder such as you envisage would presumably be a passive device. The phase inversions and sum and difference networks required would absorb a substantial amount of power from the amplifier, so that to obtain a reasonable front to back power ratio would require that the amplifier power output be more than doubled. Such an amplifier would undoubtedly cost more than a conventional four-channel amplifier.

You can't get something for nothing!

On the brighter side, there do exist quadraphonic decoders of a much simpler kind which process the output from a normal stereo amplifier and feed it to a second pair of speakers. Of course, these decoders are not capable of matching the performance of a true decoder and four-channel amplifier.

The Playmaster 136 featured in December, 1972, and the new Playmaster 143 featured in the September, 1974, issue incorporate simple decoders of this type. A commercial unit, available either as a kit or completely built, was reviewed on page 97 of the January, 1973, issue.

RADIO CONTROL: I recently purchased a book on radio control circuits for models, and was thoroughly disgusted by the antiquated designs it gave. The circuits used transistors such as OC71's, which even the army has superseded! Most of the circuits used valves, and several experienced technicians I showed it to threw up their hands in horror. Could you please help, by informing me of more modern books on this subject? Preferably, they should deal with modern transistors, and ideally with ICs. (S.V., Balcombe, Vic.)

We don't know of any modern books on this subject, S.V., but perhaps another reader may be able to help. This is a specialised area in electronics, with its own peculiar problems.

INDUCTANCE MEASUREMENT: Could you please tell me if there is any way in which inductance is measured as I have never seen a facility for measuring inductance on any multimeter? If so, have you ever published a circuit to do so? Can you measure impedance with an RC bridge or do you have to measure resistance, capacitive reactance and inductive reactance and total them up? Congratulations on a fine magazine. (R.T., Tinamba, Vic).

While it is possible to measure inductance of certain components with a multimeter using an AC or DC supply, you have to resort to some calculations to derive the answer. We have not published information along these lines. We did published a circuit to enable a standard RC Bridge to measure inductance: November 1972, (File No 7 / B / 10.)

PLAYMASTER 144: From the "run-down" on the Playmaster 144 cassette deck it sounds most impressive, and I would like to acquire one. However, I do not have the knowledge or equipment to make one, and would like to know if there is any firm which could construct one of these for me, and roughly how much this would cost. (R.F., Rapid Creek, NT).

Unfortunately, we know of no-one who does this any more. Many of the parts suppliers used to do this, but we are afraid labour costs have beaten them.

NOTES & ERRATA

PLAYMASTER 143 — PART 2 (October, 1974, File No. 1/SA/53). In the parts list on page 80, the entry "2 47uF 100VW ceramic capacitors" should read "2 0.047uF 100VW ceramic capacitors".

SOCKET SPANNER SET

32 piece metric brand new ⅛", ⅜" + ¼" drive ratchet ext bar, T bar plug spanner etc in metal case only $5.95 set. Post A 95c, B $1.10, C $1.25, C $1.35.

CIRCULAR SLIDE RULE

3¾in diameter. Will do the same work as the conventional slide rule. Instruction book included
from $1.60 each
P & P 20c.

P.M.G. TYPE TELEPHONES

Standard desk type with magneto bell calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line.

$26.00
(2 TELEPHONE SETS)

$1 cartage to rail. Freight payable at nearest attended railway station.

ALTIMETERS

Sensitive type ex Air-Force, made by Pioneer USA. $37.50.
Post: A $1.50, B $1.60, C $1.95, D $2.75.

TEN CHANNELS VHF TRANSCEIVER

Types TR 1934 100-125 MHz and TR 1936 125-150 MHz. 28 volt DC operated AM single crystal locks both TX and RX on same channel complete with generator. $33.00

MINIATURE ELECTRIC MOTORS

1½ to 3 volts DC. Ideal for model boats, cars, planes, etc. Strong torque. Only
75c each or 10 for $5
P & P 20c ea. or 10 for 55c.

AIRCRAFT CLOCKS

Genuine Eight Day Jewelled movement, sweep second hand and start of trip indicator. Dash mountings. Ideal for car rallys

$22.50 P & P $1.05.

"PLESSEY"

Producermatic 2" professional endless cartridge replay machines 2 track stereo with third cue track for machine coontrol (auto stop etc.). 600 OHM line level outputs. 240V AC operation. All silicone transistors 7½ I.P.S. 19" rack mounting. 60Hz (240V) Model $65; 50Hz (240V) Model $90. Ideal for tape idents, background music, etc. $1 cartage to rail. Freight payable at nearest attended railway station.

TELEPHONE WIRE

1 mile twin(2 miles) genuine ex-Army Don 8 perfect condition $35 per drum $1 cartage to rail freight payable at destination.

PRISMATIC COMPASSES

Genuine ex-army Mk 3, liquid damped, as new $29.50 P & P $1.05.

MORSE KEY $1.40 Post 20c. | MORSE KEY BUZZERS $4.25 Post 55c.

HALF INCH RECORDING TAPE

Top Grade 2400' on 10½" reels. Ideal Video Experimenting. Only $3.50 per reel.
P & P A. $1.55, B $1.60
C. $1.95, D. $2.75.

UNI-SELECTORS

4 bank 25 position $4 each.
P & P A. 70c, B. 85c, C. $1, D. $1.10.

ADLER FREQUENCY METER

100KHz—20MHz $95

4 DIGIT RELAY COUNTERS

50 volt DC, suit slot car Lap counters, etc.

$1.25 each. P & P 30c.

NIBBLING TOOL

Cuts sheet metal like a punch and die, trims, notches and cuts to any size or shape over 7/16inch.

ONLY $7.85
Post 55c

NIFE CELLS

1.2 Volt, fully charged, 4in x 3in x 1in 4 AH.

$1.50 each
P & P 30c.

BC221

Frequency Meters.

$35.00

HANDY SIGNAL INJECTOR

Produces an Audio Signal in rich harmonics. Ideal for Sig Tracing in A.F., I.F., and R.F. circuits. Powered by 4 Penlight Batteries with On-Off Switch and indicator lamp. Size 1½" Diam. 5" Long. Only
$6.50 Post 55c

P.M.G. TYPE KEY SWITCHES.
45c P & P 20c

TELESCOPES ZOOM FOCUSING

25 x 30 $19.95 — 40 x 40 $28.95
50 x 50 $37.50, 60 x 60 $75.00
P & P A. $1.45, B. $1.60, C. $1.75, D. $1.85.

TELESCOPES

60 magnification with a 60mm coated objective lens. With tripod.
$35.00
As illustrated.
P & P A. $1.55, B. $1.75,
C. $2.25, D. $3.25.

WALKIE TALKIES

2-way radio, 7 transistor, PMG approved, set of 2 only $48.50

1 watt, 11 transistor $130.00 set of 2.

P & P A. $1.45, B. $1.60, C. $1.75, D. $1.85.

SMALL COMPUTER PANELS

3in x 2in containing 2 valves, qty of resistors, etc.
ONLY 75c P & P 30c.

ELECTRONIC FREQUENCY COUNTER

Austronic type DFC-4 240V 50 cycle 0-100KHz $150

IMPELLER PUMPS

New gunmetal body, Stainless Steel Shaft. Neoprene Impeller. Up to 15ft. Lift, suitable for almost any type of liquid. Self priming. Ideal boat bilge pump, sullage drains, etc. Approx size 8" x 5"

⅜" $19.95
½" $22.75
¾" $27.50

P & P A. $1.45, B. $1.60, C. $1.75, D. $2.

FREQUENCY METERS

AN URM 32 A 120 KHz to 1000 MHz, with two 40V power supply, $125.00. $1.00 cartage to rail, freight payable at nearest attended railway station.

CONDENSER LENS

2½in DIAM. 2in FL. $1.50 each. Or $2.50 per pair. P & P 20c.

522 Transceivers 100-150M CS

$35.00

Cossor Double Beam Oscilloscope 1035 Tested $150

LOUD HAILER

Battery operated, transistorised. In good used condition $27.50 Post A 70c, B 85c, C $1, D $1.25.

POSTAGE KEY:

A: NSW.
B: Vic, Qld.
C: SA, NT, Tas, New Guinea,
D: WA.

VALVES

BRAND NEW IN CARTONS

807	$1.50	CV850 $1.50
65N7GT	95c	1H6G 75c
5U4G	95c	832 $5.00
EF50	75c	6AG5 80c
5Y3	$1.99	6X4 $1.00
2x2	75c	VR64 75c
		VT4C 75c

P & P 30c

PARABOLIC REFLECTORS PYREX MIRROR

36" dia. Ideal solar radio optical experimenting also decorating purposes. $37.50 Sorry shop sales only.

RADAR TRANSCEIVER

X BAND WITH KLYSTRON ETC. $45.00

5" CRO TUBE

5 BPI $5.50 each.
Post: A 85c, B $1.10, C $1.25, D $1.35.

TELESCOPE

30 x 30 with leather case $5.85. P & P 55c.

CHASSIS PUNCH SET

Five sizes: ⅜ inch, ¾ inch, ⅞ inch 1 inch and 1⅛ inches. With taper reamer. $17.95
P & P A. $1.45, B $1.60, C. $1.75
D. $1.85.

SELSYN MOTORS MAGSLIP

Md. 11.....$5.25 ea.
No. 19 TWO-WAY RADIOS.
Power supply, accessories, etc., $35.

BINOCULARS

PRISMATIC Coated Lenses. Brand new. Complete with case.

7 x 35 Wide Angle	$35.50
8 x 40 Wide Angle	$39.50
7 x 50	$31.50
10 x 50	$32.50
12 x 50	$33.65
20 x 50	$37.95

P & P A. $1.45, B. $1.60, C. $1.75, D. $1.85.

3000 TYPE RELAYS

P.M.G. 200Ohms — 1'500Ohm Coils $2.50 each. P & P 30c.

SPY TELESCOPES

8 x 17 mag size of a rifle cartridge extends to 8". Only $3.50 each, post 55c

Cintel Oscillator and Electronic Counter, type 388.

$250

SPECIAL lucky dip valve offer, 15 new valves in cartons for only $2.95. We haven't got time to sort them, so you reap the benefit.
P & P A. 60c, B. 85c, C. $1, D. $1.10.

CONDENSER LENS

1½in diam. 1½FL. 50c each.
P & P 20c

BATTERY CHARGERS BRAND NEW WITH METER

plugs into 240V power and gives both 6V and 12V DC output. 4 amps with hi, medium and low charges.
Dimensions, 9" x 5" x 5" $45 value only

$32.50
P & P A. $1.55, B. $1.60
C. $1.95, D. $2.75.

EX ABC RECORDING TAPES TOP BRANDS

¼" x 1200' on 7" reels. $2.50
P & P A. 60c, B. 85c, C. $1, D. $1.10

SOLENOIDS

Plunger Type 12V 300MA. Suit electric camera control, miniature trains, radio. etc.
$2.50 P & P 20c
200 MA 24 volt, ⅛in push movement.
$2.50 P & P 20c.

ZOOM FOCUSING MICROSCOPE

Battery and mirror illuminated 900x magnification. Complete with dissecting kit slides etc.
P & P A. $1.45, B. $1.60,
C. $1.75, D. $1.85. $29.95

TRANSCEIVERS Ex Army

No 10 set, 38 to 55MHz with hand piece $22.50. Battery to suit $3.50 extra.
No C42 set, 36 to 60 MHz complete with 24V power supply, headphone, mic, leads etc $65.00.
No C45 set, 23 to 38 MHz complete with mast, headphones, mic 24V power supply etc. $95.00.
$1.00 cartage to rail, freight payable at nearest railway station.

Crystal Earphone 75c P & P 20c

Cassette head cleaners $1.50 P & P 20c

POCKET MULTIMETER

Volts A.C. and D.C. 15 to 1000 volts (3 Scales) Current D.C. 150 M.A. Resistance 1000 K Ohms Only $8.95
P & P 55c

COMMUNICATIONS RECEIVER

TCA R5223 Communications Receivers. These receivers don't cost as much as a R390 A or a RACAL but give you the opportunity of having a unit with a similar performance at a fraction of the cost. Continuous tuning from 1.5 to 30.5 Mhz. bands. First conversion is crystal locked into a 2.5 to 3.5 Mhz tunable second IF. 1 uV sensitivity. Drift from switch on to fully warmed up less than 3 Khz. Dial reset to less than 1 Khz. Calibration to within 3 Khz. (typically within 1 Khz.). Operation from 240V, 110V AC or 24V DC with inbuilt power supplies. 19 inch rack mounting. Accepts coaxial 50 or 75 ohm antennas. Diversity operation possible IF output for panadaptors etc. Complete with leads, headphones a bargain at $250.00 Cartage to rail $1. Freight payable at nearest attended railway station.

A.W.A. SIG GENERATOR

UHF 140-300 MHz $65.00

TRANSPONDER APX6

with Lighthouse Tubes. Can be converted to 1200 MHz. $17

Deitch Bros.

70 OXFORD STREET, SYDNEY 2010

SORRY. NO C.O.D.

Marketplace

FOR SALE

COLOUR PICTURE TUBES, 13in type 320ADB22, standard 14 pin base, 6.3 volt heater. Ideal for bench testing of colour chassis. New, $65.00. Send crossed cheque to Teleservices, 842 Canning Hwy, Applecross, 6153, WA.

SPEAKERS: 2 pairs Bailey Mk 2 transmission lines. Excellent sound. Best Offer, (02) 7314 after 6 pm.

FETS 5 x 2N3819E + data $2; 5x BC107/8/9 $1; 5x 2N3053 $2; OC25 80c; 30x 160V ply caps .001 — .018 $1; 4x Comp bds $1; 4W audio amp Mullard $5. Surtran, Box 317 GPO Sydney.

BARGAINS for December only. All new, current stock. 1N4004 diode (replaces EM404) 16c each or 10 for $1.40; Bridge rectifier, 400V 1.5A, $1.50 each; 5pc 1/2W carbon film resistors, 25c for 10 of one value. P&P 40c. ECM Industries, Box 309, Hawthorn, Vic 3122.

ALL BACK ISSUES "Electronics Aust.", 50c per copy. Door sales only. T. Weir, 56 O'Connor St., Haberfield, 798 7569. Wanted to buy copies also.

BC221 AK, new in orig. case incl. 240V supply, headphone. Ex War Dep manual TM 11-300 covering all models etc. Best Offer, PO Box 101, Epping 2121.

ELECTRONIC COMPONENTS for sale. All new. Write to ECM Industries, PO Box 309, Hawthorn, Vic 3122, for free price list.

UNTESTED & UNGRADED transistors or diodes. "Fantastic Value" ideal for hobbyist, tradesman & experimenter, packs of 160 for $2 — plus pack & post 50c. Send cheques or m.o. to "Transistors" 22 Mitchell Ave, Boronia, Vic 3155.

ELECTRONIC ORGANS

Do not start to build yourself an organ without first finding out about the superb **SCHOBER (USA)** assemble-it yourself kits. Inquiries to **Schober Organs (Aust), 124 Livingstone Ave., Pymble, NSW, 2073.** (Mail only please.)

SERVICE

CONVOY INTERNATIONAL OFFERS SERVICE ON ALL HI-FI EQUIPMENT AT SYDNEY'S LOWEST PRICES
FREE PARKING

Special tape recorder adjustment, our technicians can adjust your tape recorder so that it gives super performance on the brand of tape you use. You will be amazed at the improvement in performance for such a small charge.

Convoy PTY/LTD

CNR. PLUNKETT & MACLEAN STS, WOOLLOOMOOLOO — 357 2444 OPEN THURS NIGHTS & SATURDAY.

CRYSTALS XTAL 27 240, 26 785, ¼ inch pins — $6.00 per pair post free. P. Shalley, 127 York St, Sydney 2000.

INTEGRATED CIRCUITS 7400, 7404, 60c; 7490, 7491, 7473, 7474, NE555 $1.75; uA741 $1.00; EM404 10 for $2.50; unmarked uA709 50c; relays, min. 12V 4c/o with base $1.25; computer boards 50c & $1.00; bundles hook-up wire 100ft 50c; post & packing 20c. Burnlee Trading, P.O. Langwarrin, 3910, Vic.

AR7 WITH MAINS PACK and 4 coil boxes 140kHz to 25MHz. $120. Circuit Breakers approx. 20 Heinemann & Westinghouse, 250V 10A, new — $4 each. O'Brien, Edgar Rd, San Remo, Vic. 3925.

ALL MUSICAL INSTRUMENTS, amplifiers and accessories. Electronic calculators, cassettes, etc, buy from local & overseas wholesalers & mfrs through us, extra special deals for quantity buyers. Mail order music dept. Lethean, PO Box 55, Albert Park, Vic 3206.

BACK ISSUES "Electronics Australia" complete April 1965 to March 1974. Offers please — Campbell, PO Box 21, Canterbury, Vic. 3126.

SINCLAIR STEREO 60 PREAMP/CONTROL UNITS, including volume, bass, treble & balance. We are clearing stocks below wholesale price at only $24.90 each plus $1.00 p&p. Only a limited amount available at this incredibly low price, save yourself many $$$$. Hurry and get yours while stocks last. HI-TEC ELECTRONICS, 265 Princes Highway, Corrimal, N.S.W. 2518.

FILMS, Sound 8-16mm. Sell, exchange. Projector Magnetic R P heads, raised pole non scratch. Halpin, 12 Swinbourne Ave, Hawthorn, Vic 3122. Phone 81-4724.

SUPER BARGAIN SPECIALS from MICRONICS. TOP QUALITY PIGTAIL ELECTROLYTICS SALE. HURRY, ORDER NOW!!! 25uf/450v, 50uf/300v, 60uf/300v, 100uf/200v, 2000uf/25v — 3 for $2. 16uf/450v, 32uf/300v, 200uf/70v, 1000uf/18v—4 for $2. 10uf/500v, 50uf/125v — 6 for $2. 1000uf/6.5v — 5 for $2. 2000uf/40v — 3 for $2.50, 2uf/40v — 10 for $1, 10uf/65v — 10 for $1.50, 40uf/70v — 10 for $2, 2uf/300v — 10 for $3, 500uf/25v — 10 for $2.50. TUNING CAP. Miniature — 2 for $1.30. Large 2 gang — $1.25, 3 gang $1.75. Slide Switch (18 pin) — 4 for $1. Power Switch, 4 pos., Push Butt. — 2 for $1, MICRO switch 250v, 10A — 2 for $1, Trimmers (0-220pf) — 10 for $1.50. ZENER DIODES — 400mv, 4.7v — 10 for $1.80. COPPER CLAD Board 6" x 9" — 4 for $2. 6" x 12"— 3 for $2. Ferric Chloride Etch. (Solid) 100 grm bag — 40c.

SEMICONDUCTORS: BC179, BC157, 2N3638A — 6 for $2, AC126 — 5 for $2, AC127 — 4 for $2, AD161/162 Mtchd Pr — $2, SE1010 — 5 for $2. Rect. Diode 1N3196 (800v, .75A) — 10 for $2. DG14 Damper Diode for TV $1, 2N3730 — $1.25. AUDIO AMP I.C. incl. Cct Diagram PA234 1w R.M.S. — $1.25 ea., TAA621 4w R.M.S. — $3.50. POTENTIOMETERS — Single Pots 250k/A, 250k/C — 4 for $1. Single with switch 1M/C,

DISPLAY ADVERTISEMENTS IN MARKETPLACE are available in sizes from a minimum of 6cm x 1 col rated at $45 per insertion.
Other sizes are at card rates.

CLASSIFIED RATES $1.50 per line per insertion payable in advance. Minimum two lines.

CLOSING DATE is six weeks prior to the on-sale date. Issues are on-sale the first Monday of each month.

ADDRESS all classified orders, copy, enquiries, etc. to: The Advertising Manager, ELECTRONICS Australia, Box 162, Beaconsfield, 2014.

LANTHUR ELECTRONICS

69 Buchanan Avenue, North Balwyn. 3104. Victoria. P.O. Box 162. Ph. 85 4061.

BASIC BATTERY SAVER KITS

Use instead of batteries in radios, tape recorders, record players, toys, instruments etc. Consists of tapped transformer, rectifier, filter capacitor and circuit. Will supply dc voltages from 6 to 15.
One amp. size. $8.50
Two amp sixe. $13.50
Plus postage. Vic. 0.75
Other $1.50
Excess postage will be refunded.

BASIC BATTERY CHARGER KIT

Charge your own car battery. Consists of transformer, rectifier, ballast resistor, nnd circuit.
Charges 12 volt batteries at 2 amps. $8.50
Plus postage. Vic. 0.75
Other $1.50
Excess postage will be refunded.

BASIC MOTOR SPEED CONTROLLER KIT

Controls from full to stop without loss of torque. Suitable for brush type ac dc motors only. Especially drills and other hand tools etc.
Three amp. capacity. $7.50
Price includes postage.

BASIC LAMP DIMMER KIT

Will control incandescent lamps from full to out. Capacity up to 1400 watts. Consists of triac, diac, pot., knob, inductor, caps., resistors and circuit. $6.50
Prices includes postage.

PLASTIC CABINET

Suitable to contain motor speed or lamp dimmer kits. $1.35
Price includes postage.

BROADCAST BAND TUNER

Complete ready to use. Use with hi-fi amps., tape recorders etc. Band width 8kh, output 1/2 volt, dc input 9 volt 5 ma. $27.75
Price includes postage.

AMMETERS

Moving coil type. 0 to 10 amps. dc. Clear face 65 x 55 mm. $4.50.
Price includes postage.

SELENIUM PLATE RECTIFIERS

Air cooled type. 6 amps. 25 volt mx. 4 plates 67 x 70mm. $5.50
Price includes postage.

FERRITE RODS

Eight by three-eighth inches. 75 cents ea. Three for $2.00
Price includes postage.

MAGNETIC EARPIECES

Complete with cord and 3.5mm plug. 50 cents ea. Five for $2.00
Price includes postage.

STEEL BOXES

Grey hammertone finish. Detachable top & bottom. Size inside 5 1/2" x 5 1/2" x 4 1/4". One side has a 1 3/8" and a 1/2" hole. New & unused. $1.25 ea.
Four for $3.95
Price includes postage.

TRANSISTORS

2N3055 $1.50 ea.
Four for $5.50
Price includes postage.

ELECTRIC MOTOR SPEED CONTROLLERS

Suitable for drills & other hand tools or any brush type ac dc motor. Complete, ready to use & approved by the SEC. Reduces speed from full to stop without loss of torque.
500 watt 2 amp. size. $15.75
Price includes certified post.
2500 watt 10 amp. size $23.90
Plus certified post. Vic. $1.00
Other $1.50
Excess postage will be refunded.

MARKETPLACE — Cont.

5k/C, 250k/C — 3 for $1. Dual Gang 2M/A, 250k/A, 1M/C — 2 for $1. Dual with switch 2M/C, 500k/C — 75c ea. Slider Pots, single 250k/A — 40c ea. Stereo 5k/A — 80c ea.

SUPER BARGAIN PACKS. IDEAL FOR SERVICEMAN or HOBBYIST. TRANSISTORS: NEW, BRANDED, POPULAR pnp and npn Germanium types (Mixed) — 10 for $2. POWER RESISTORS 3w-7w, 5pc, 10pc. Top Qual. (Mixed) — 25 for $2. RESISTORS, Fresh Stock (Mixed) 5pc, 10pc, ½w, 1w, ideal for servicing, V.H.F. or hobbyist — 100 for 90c. POLYESTER CAPS, Top Qual. 160v, 270v, 400v, 10pc Tol. (Mixed) — 100 for $3.25. POTS — Dual, single, switch and Tab pots (No Rubbish) — 20 for $3.50. PRESET POTS: Mixed excel. quality — 10 for $1. CERAMIC DISC CAPS, mixed — 50 for $1 (incl. high voltage). ELECTROLYTIC CAPS mixed — 25 for $2. STYROSEAL CAPS — asstd for $1. TANTALUM CAPS — All mini, mixed — 20 for $2 (No junk). ZENER DIODES — Mixed 1w — 10 for $3.50, Mixed 10w — 10 for $6. SWITCHES — Incl. Rotary, Micro and P.B. switches — 10 for $3.50. TAG STRIPS — Mixed — 50 for $2. COILS — Miniature Coils Osc. I.F. mixed, unmarked — 20 for $1.50. Post and Pack 30c or extra for Heavy parcels. MICRONICS, P.O. Box 175, Randwick, N.S.W. 2031.

READER SERVICE

FREE CATALOG listing details of solid state digital clocks; stereo amplifier kits; 100W RMS power amplifiers; IC audio amps; CMOS IC's; Red, green yellow LEDs etc. Write to GMR, PO Box 127, Malvern, Vic 3144.

FREE! PRICE LIST of bargain components with order form. Send 9in x 4in SAE to MICRONICS, PO Box 175, Randwick 2031.

LOUDSPEAKERS REPAIRED. Bass resonance lowered with foam plastic suspension or grey cloth. 10in Plesseys modified with plastic surrounds & cone painted with saturant for lower colouration and smoother frequency response. Contact Norman J. Edge, 359 Nepean Hwy, East Brighton, Vic 3187.

AUSTRALIAN RADIO DX CLUB. For overseas and long distance shortwave and medium wave reception for serious DX monitors. Monthly bulletin, and special supplements. Send 20c stamp for membership details to ARDXC, PO Box 227, Box Hill, Vic. 3128.

MULTIMETER & INSTRUMENT REPAIRS. Fast service to all makes of meters & test equipment including AVO and Japanese types. Western Meter & Instrument Service, 31 Hazel Street, Girraween, NSW 2145. Phone Sydney 631 2092.

WANTED

THE FOLLOWING VALVES required for Eddystone Marine Receiver: 659/670; UAF.42; UCH.42; UL.41; UL.41; UAF.42; UAF.42; UCH.42. Please advise if incorrect. C. T. Frith, PO Box 24, Morwell, Vic 3840.

ONE DIAL ASSEMBLY Efco USL-37 to suit Little General 1961 mantel radio. Apply C. Borchard, 719 Blende St, Broken Hill, NSW 2880.

WEBSTER BOOTH 78 records. Cash collect. Phone 31 6426 (Sydney) evenings.

TUDOR RADIO

L.E. CHAPMAN EST. 1940

103 ENMORE ROAD, ENMORE, NSW 2042. PHONE 51-1011

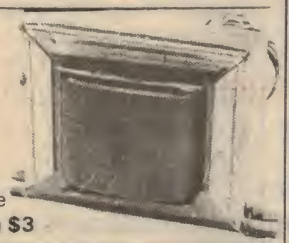
NEW Postage Rates Please Add Extra

TV Picture Tubes. New in cartons 21 inch 110 deg. **$22**, 17 inch 110 deg. **$18.**

T.V. channel change and fine tuning · Knobs **75c** a pair.

TV tuners new in valve type or transistor **$10** each.

A.W.A.
Stereo Amplifier
and tuners solid state.
5 Watts per channel
$40 Pack and Post $1.50.
Interstate $2.

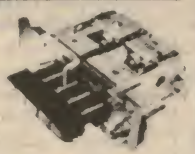


Power Transformer, 150 Volt aside 6 Volt Winding **$3**

Super special B.S.R. 4 speed record changer 12 inch turntable balanced arm cuing device etc. **$35**, pack and post **$1.00**, Interstate **$1.50.**

Portable 4 speed record player 240 volts all transistor **$19.50.** Pack and post **$1**, interstate **$1.50.**

SUIT HOMODYNE TUNER
Car Radio Push Button Tuner
$4.50
Pack & Post 55c Interstate $1.05



SLIDE SWITCH
3 position **50 cents**

Shure M 75/6 Magnetic Pick up Cartridge **$11.**

Speaker transformers 7000 to 15 Ohm 3½ watt **$1.25.**

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100 mixed condensors micas polyester ceramic fresh stock **$2** per pack and post 45c.

Perspex tops for record players size 12 x 9⅜ x 3¼ **$1.50.**

50/Ohm pots ideal for ext. speakers etc **50c.**

Speakers M.S.P.

12 UAC 8/OHM 30 WATTS RMS	**$22.00**
12 TACX in 8 or 15 OHM 10 WATTS	**$11.00**
8 TACX 8/OHM	**$8.00**
6 x 9 in 8 or 15 OHM	**$7.00**
5 x 7 in 8 or 15 OHM	**$6.00**
6½ inch 8 or 15 OHM	**$4.50**
8 x 4, 8 or 15 OHM	**$4.50**
6 x 4, 8 or 15 OHM	**$3.50**
5 x 4 15 OHM	**$2.50**
4 inch, 8 OHM	**$2.75**
4 inch large magnet 15 OHM	**$3.00**
3 inch 3.5 OHM	**$2.50**
5 inch Tweeters 8 OHM	**$3.50**
4 MB Tweeters	**$5.00**
6 inch Dual Cone Tweeters	**$6.00**
5 x 3 80 OHM	**$3.00**
5 inch magnavox dual cone 8" 27 OHM	**$6.00**
8 inch national built in Tweeter	**$14.00**
rola custom kit 63G x Tweeter C60 woofer cross over and pot	**$19.00**

TUNING AND BALANCE INDICATOR METERS **$1.50**

Tape Recorder Heads Transistor Top quality suit most recorders **$5.00**

Speaker transformers 5000 to 15 Ohm 5 watt **$2**

Morganite and IRC resistors 33 values **$2** per 100 pack and post 45c.

BSR Ceramic Cartridge Stereo **$4.**

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250 mixed screws. BA, Whit, self-tapper bolts, nuts, etc. **$1.25** bag plus 40c post

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Speakers Magnavox 8 inch 4/OHM **$5**

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25 mixed 5 and 10 Watt resistors **$2.00.**

B.S.R. 4 speed gramophone motor and pickup 240 volt $7.75.

Hook up Wire 30 mixed colours lengths **$1** bag.

Amplifiers 5 x 3, 5 x 1½, 5 x 2½, 6 Volt complete ideal for record players also preamp stage included **$5**

50/0 hm Pots ideal for ext. Speakers 50 cents. Transistor and Driver Speaker Transformers **$1.00** pair. Ferrite Rods 6½ x ½ inch **50 cents**

Pots 30 mixed values including ganged and concentric **$5**

In Line Fuse Holders **20 cents**

Stereo Speaker Wire **12 cents** yard

Amplifier Solid State 8 Watts RMS per Channel **$35** pack and post $1.50 Interstate $2.00.

Shielded microphone cable **30cents** Yard

Car radio supressor condensor **30 cents**

Speaker transformers 7000 at 3.5 OHM **$1.25.**

Electros 3 in one 100-25-40, 24-250-300, 50-250-300 **75 cents**

Electros 100 MFD 400 Volt **$1.00.**

Speaker transformers 12,000 to 15ohm **$1.25.**

Advertising Index

How to graduate to 4-channel sound. Study the TEAC A-2340R.

It's TEAC's breathtaking 4-channel A-2340R.
A dynamite open-reel tape deck that gives you "surrounding" sound.
Puts you right in the middle of the band.

Here's what it can do.

First, the A-2340R records and plays in four-channel, two-channel or monaural.
It can handle any kind of recording and playback you demand of it.

Then there's the Automatic Reverse playback for two-channel play. Stereo tapes get a complete run through. When side I finishes, side 2 begins. Automatically.

And the built-in mic-line mixing capability allows you to mix, record and be as creative as you like in making tapes.

And to assure stable and constant tape run, the A-2340R has three motors.

All in all, it's one of the easiest to operate tape decks on the market.

All at a price you'd pay for a top quality stereo deck.

Now, go study the A-2340R at your next opportunity.

TEAC

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